Railway Maintenance Engineer

me 13 | CHICAGO: Transportation Building NEW YORK: Woolworth Building | JANUARY, 1917 | CLEVELAND: Citizens' Building WASHINGTON: Home Life Building | Number 1

Crossing of the Lake Shore & Michigan Southern Ry., and the Cleveland, Southwestern & Columbus Ry.

They Soon Pay for Themselves by Reduced Maintenance

Picture in your mind's eye a one-piece crossing foundation in which every square inch comes into effective bearing. That's the International Steel Crossing Foundation. No portion can move unless the entire crossing moves. Rails cannot work loose. Patented clips hold against all vibration and strains. Bolt breakage is practically eliminated. Think what the spring thaws and a soft, "boggy" roadbed do to your wood-tie crossings. Then remember the characteristics of an International Foundation. Now you can see why they soon pay for themselves by reducing maintenance—and at the same time they double or triple the life of built-up crossing frogs by obviating bolt breakages.

International Steel Tie Co. :: Cleveland

The CINCINNATI FROG & SWITCH COMPANY
MANUFACTURERS OF
TRACK EQUIPMENT
FOR STEAM AND ELECTRIC RAILROADS
MINES AND MILLS

CINCINNATI, OHIO

Frogs *Switches* *Crossings* *Stands*

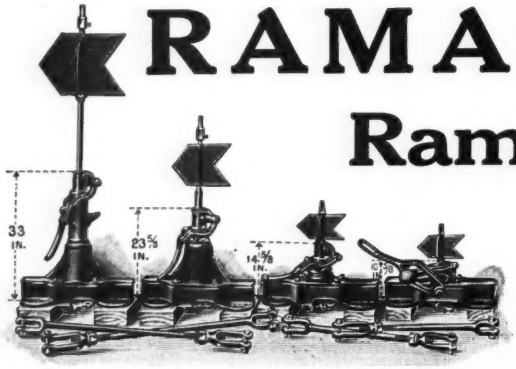
FROGS — SWITCHES — STANDS

Manganese and Built-Up Construction

IN STOCK for IMMEDIATE SHIPMENT

THE INDIANAPOLIS SWITCH & FROG COMPANY
NEW YORK SPRINGFIELD, OHIO CHICAGO

RAMAPO



Automatic Safety Switch Stands are Manufactured only by the

Ramapo Iron Works

Write for Descriptive Catalogues on
Switch Stands, Switches, Frogs, Guard Rail Clamps, Etc.

Manganese Track Work a Specialty.

Ramapo Iron Works Main Office: HILLBURN, N. Y.
WORKS: Hillburn, N. Y., and Niagara Falls, N. Y.

ESTABLISHED 1882

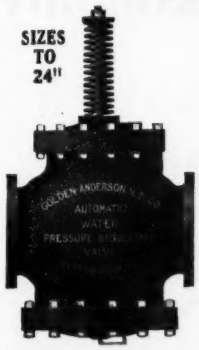
THE WEIR FROG CO.

Track Work of Rail and Manganese Steel Construction

CINCINNATI --- --- --- --- --- OHIO

Safeguard Your Service during hard weather by Golden-Anderson Automatic Valves

SIZES TO 24"



Golden-Anderson Patent Automatic Cushioned Water-Regulating Valves.

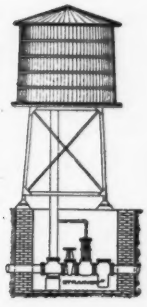
G.-A. Pat. Cushioned Controlling Altitude Valves

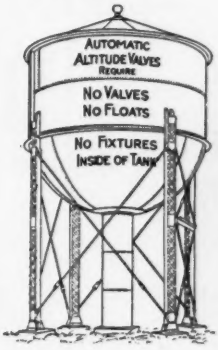
Automatically maintain Uniform Stage of Water in Tank, Reservoir or Standpipes. Do away with the Annoyances of Freezing and Float Fixtures inside or outside of tanks.

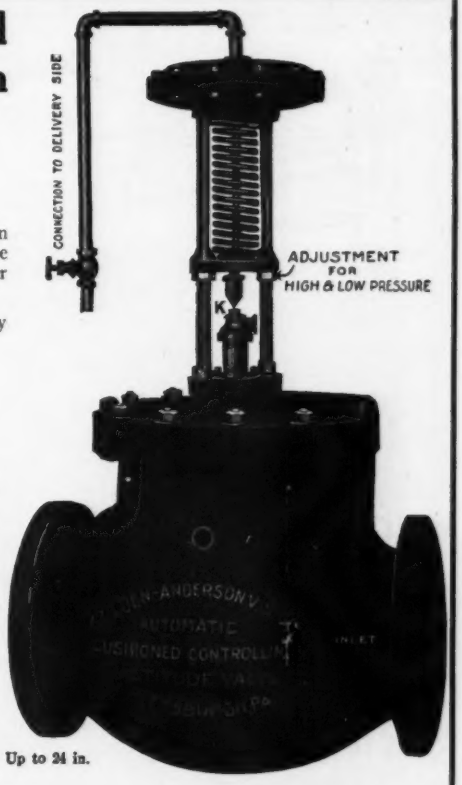
Operated in either of three ways: Automatically by water; by electricity, if desired; by hand.

"No Metal-to-Metal Seats"

"Hosts of References"







Up to 24 in.

(Angle or Straight Way), up to 24 in.

Golden-Anderson Automatic Cushioned Float Valves.

Golden-Anderson Valve Specialty Co.

1200 Fulton Bldg. Water and Steam Specialties. PITTSBURGH, PENNA.

KILBY FROG & SWITCH COMPANY

Birmingham, Alabama

Manufacturers of

Frogs, Switches, Crossings, Etc.

Manganese Track Work a Specialty

Front View

Built for Railway Construction Work

In the first place bear in mind that the "Emerson" is used for washeries, in cofferdams, for bridge building, railway tanks, roundhouses. In short, where construction engineers are after positive service, they specify

EMERSON STEAM PUMPS

Emerson Standard Pumps have the Emerson Patented Engine and Valve with its positive mechanical motion — thus steam is admitted into the barrels of the pump at positively timed intervals. Engine, valve and gear are hermetically sealed and cannot be injured or clogged.

The EMERSON is a steam vacuum pump built and designed to handle air, sand, mud, grit, etc., in percentages with the water absolutely impossible by any other kind or make of pump.

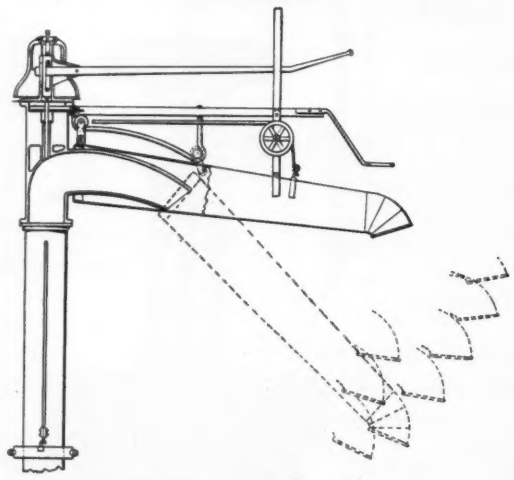
IMMEDIATE SHIPMENTS FROM STOCK

Write for Catalogue No. 12, with Testimonials

The Emerson Pump & Valve Company

Alexandria, Va.

Side View



DO YOU LOOK FOR THESE FEATURES IN A WATER COLUMN?

DROP SPOUT POSITIVELY NON-FREEZABLE

Non-freezable telescopic joint over the discharge nozzle of the tee—a joint that is entirely open, without packing or working apart, yet does not waste a bit of water.

WITH ABSOLUTE FLEXIBILITY

The greatest possible flexibility—a vertical adjustment range of five feet and a lateral adjustment range of three feet.

QUICK CLOSURE WITHOUT WATER HAMMER

A valve mechanism so constructed as to positively eliminate water hammer even when the column is connected to a high-pressure main. The University of Illinois comparative tests showed that the Poage Style H Valve offered the least frictional resistance to flow and that the valve closure is correct (University of Illinois Bulletin No. 48).

These features are found only in the

POAGE STYLE H WATER COLUMN EQUIPPED WITH THE FENNER DROP SPOUT

Actual everyday usage has proven that the Poage construction principles are correct. Give the Poage Style H Water Column a rigid tryout—see for yourself how maintenance costs are cut and time is saved. Write for illustrated booklet *now*.

The Poage Water Column and The Fenner Drop Spout are manufactured exclusively by

THE AMERICAN VALVE & METER CO.
CINCINNATI, U.S.A.

Quality Is Economy

Railroad Managers and Engineers Specify

DIXON'S SILICA-GRAPHITE PAINT

because it shows the lowest yearly cost when you divide the many years of paint service into the FIRST COST. We have made this paint for over fifty years in FIRST QUALITY only. This is a guarantee of best service, best quality and highest paint economy.

Dixon's Silica-Graphite Paint affords the most tenacious and resistant film known.

In specifying Dixon's Paint you will not be disappointed. Records tell of services of eight to fifteen years on railroad bridges. It is used by leading railroads all over the world.

If interested, write us for full particulars and Booklet 187 B.

Made in JERSEY CITY, N. J., by the

JOSEPH DIXON CRUCIBLE COMPANY
Established 1827

Increase Crossing Life and Reduce Maintenance Costs With International Steel Crossing Foundations

These structures add 100 per cent to the life of new crossings, greatly reduce maintenance costs, and they will prolong the life and decrease maintenance charges on old crossings. The two crossing foundations shown in the above illustration were installed at the intersection of the C. C. C. & St. L. R. R. and the W. & L. E. R. R. at Wellington, Ohio. Although the traffic included forty trains each way on the double-track line and eight trains each way on the single-track line, the cost of installation under the old crossing frogs was exceedingly low.

Cost of unloading and trucking substructure from car to point of installation	$18.00
Placing new substructure	12.50
Back-filling and surfacing	5.00
	$35.50

Support your crossings, new or old, on INTERNATIONAL STEEL CROSSING FOUNDATIONS and save money. They are inexpensive and easy to install. Send us blue prints of your crossings and let us submit quotations.

SHIPMENT IN THREE WEEKS

The International Steel Tie Company

General Sales Office and Works, Cleveland, Ohio

REPRESENTATIVES:

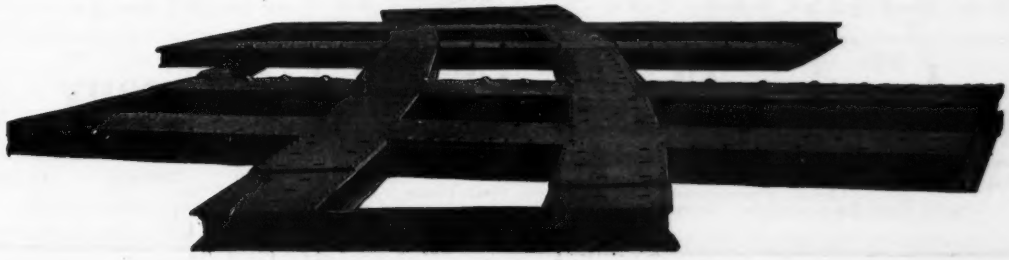
Maurice Joy, Philadelphia

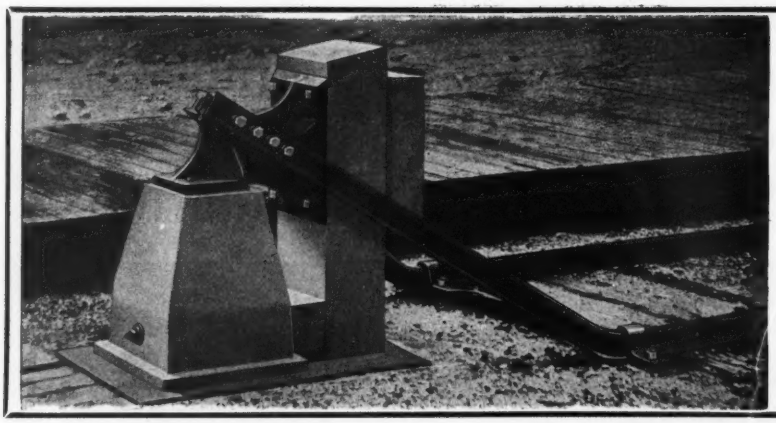
William H. Ziegler, Minneapolis

Western Eng'g Sales Co., San Francisco, Los Angeles, Seattle

R. J. Cooper Co., Salt Lake City

J. E. Lewis & Co., Dallas





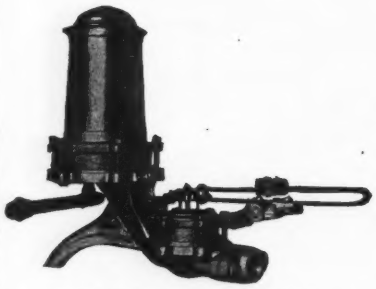
ELLIS

PATENT

Bumping Post

Simple, Strong and Lasting
Adapted to All Positions

Mechanical Manufacturing Co.
Chicago, Ill.



RIFE HYDRAULIC RAM

WHY PAY FOR FUEL?

Why pay for fuel and hire an attendant when the **Rife Hydraulic Ram** will keep the tank full with no more than occasional attention by the section boss?

Why install a steam or gasoline-engine driven pump if you have the water supply and head required for driving a **Rife Hydraulic Ram?**

Its reliability under all conditions of service is being convincingly demonstrated every day in supplying watering stations on 42 railroads in this and foreign countries.

Write for our booklet which tells how the Rife Ram will eliminate your pumping charges.

RIFE HYDRAULIC ENGINE MFG. CO.
111 Broadway **New York, N. Y.**

The Thermometer of Production is Rising Steadily—

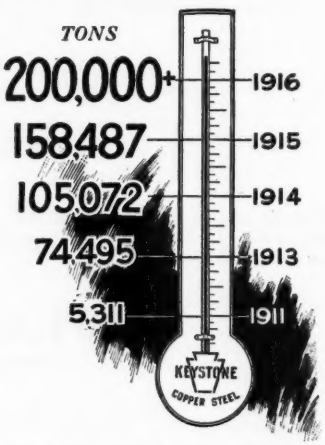
KEYSTONE COPPER STEEL

Keystone Copper Steel

Sheets and Terne Plates have received heartiest approval from consumers. The constantly increasing consumption of KEYSTONE Products is in itself sufficient proof of superiority.

CULVERTS, TANKS, FLUMES

and exposed sheet metal work give unexcelled service and rust-resistance when APOLLO-KEYSTONE Galvanized is used. Positively unequaled for Railway Culverts, Roofing, Siding, etc.



Send for our interesting booklet—"Keystone Copper Steel—A Discussion on Corrosion"

American Sheet and Tin Plate Company

GENERAL OFFICES: Frick Building, PITTSBURGH, PA.

DISTRICT SALES OFFICES:

Chicago Cincinnati Denver Detroit New Orleans New York Philadelphia Pittsburgh St. Louis

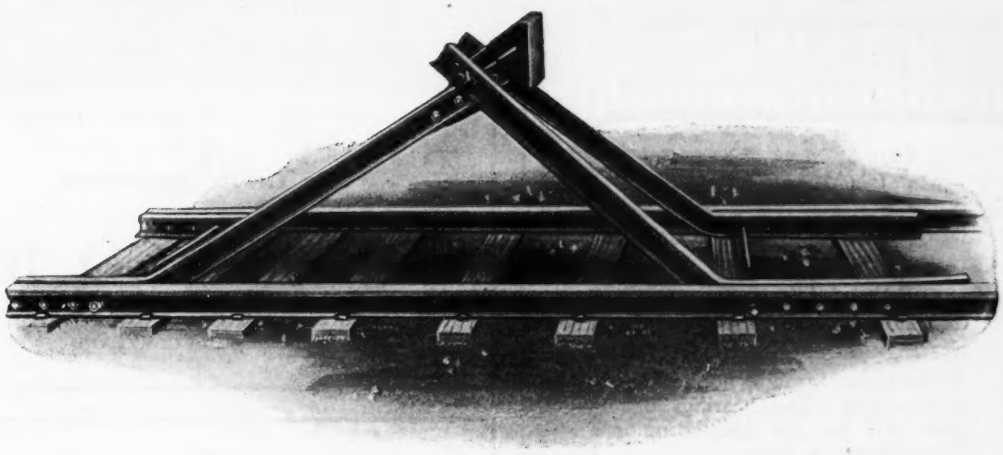
Export Representatives: UNITED STATES STEEL PRODUCTS COMPANY, New York City

Pacific Coast Representatives: UNITED STATES STEEL PRODUCTS COMPANY, San Francisco, Los Angeles, Portland, Seattle

BUDA ALL STEEL

PATENTED

BUMPING POST



Appearance of Buda All Steel Bumping Post **in a comparative test,** after being hit by a car of coal, total weight 68 tons, at a speed of six miles per hour, on a down grade of 3½%, equaling 71,808,000 foot-pounds impact. **No damage done to car,** resiliency of the post acting as a spring buffer.

If you are interested, we should be glad to furnish you full particulars of this test. The only post that was not injured or totally demolished.

The Buda Company

30 Church St. **Railway Exchange Bldg.** **113 No. 2nd St.**
New York **Chicago** **St. Louis**

THE HYATT FLEXIBLE ROLLER BEARING.

Would you

build a house on a flimsy wooden foundation, and then expect it to last? Certainly not. The foundation of a house must be stronger than the house itself.

¶ The same reasoning applies to section cars. The bearings of your cars are the foundation. They cannot be flimsy.

¶ They should be strong, rugged, durable, easy running.

¶ The Hyatt Bearing is all of these, and furthermore, it is a big money saver.

¶ Hyatt Roller Bearings on your railway cars will cut down your gasoline bill 30%. An average railroad having one gasoline car for every ten miles of main track can save $21,000 per year with Hyatt equipped cars.

¶ And Hyatt equipped push and hand cars will save money on labor. One man can push or pull as much as two men.

¶ Your manufacturer can supply you with Hyatt equipped boxes. And these boxes will interchange with your old ones. Therefore, old cars can be Hyatt equipped at small expense.

¶ In ordering new cars apply common sense efficiency. Be sure to specify Hyatt bearings.

¶ The second edition of Bulletin 1100 is out. Send for your copy.

Hyatt Roller Bearing Co.
Newark, New Jersey

1103

A coating which DOES protect bolts, nuts, lag screws, etc.

LOHMANNIZED

With Lead Alloy Coating

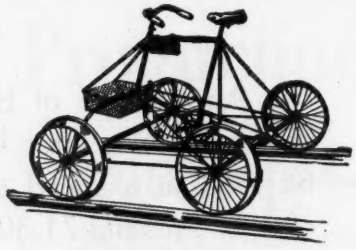
Threads All Protected —No Re-Cutting

Three Years in tunnel use combating salt water seepage and gases found these bolts ***"still going strong"***

We Invite Inquiries

JOHNS & CO., Inc.

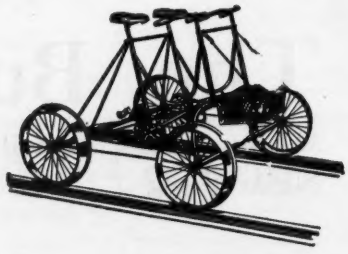
50 Church St., New York
TELEPHONE 7230 CORTLAND



STRONG. LIGHT-RUNNING

Inspection Cars

are our specialty. We make them to fulfill any and all requirements and our success is attested by the repeat orders from roads that have given them a trial. Our new catalog contains full information and will be sent to you on request.



TEETER-HARTLEY MOTOR CO.
HAGERSTOWN, INDIANA

AMERICAN

The Kind of Pump Quality That Commands Satisfaction

In nearly every "American" pump advertisement an actual pump installation is shown. Moreover the name and complete address of the owner is given so that anyone can verify every claim we make in reference to "American" pumps.

During the last two years about 100 pump installations have been shown and in nearly every advertisement the characteristics of the pump are given. In this time there has never been a question that we claimed an efficiency that we could not prove.

The fact is "American" pumps possess a quality of which we are not ashamed. It is our faith in that quality that impels us to constantly offer you the opportunity to prove our statements.

The above illustration shows two views of a pump installed by us about two years ago in the Blue Island Power Plant of the Public Service Company of Northern Illinois.

This unit is an "American" 6 in., Type D S T D, horizontal single stage, double suction centrifugal pump, completely bronze fitted, driven by a 53 h.p., horizontally split shell, Kerr steam turbine, operating non-condensing. The pump is designed to deliver 1,000 g.p.m. when operated at 2,400 r.p.m. and takes water from the river and delivers it into the general distributing system of the plant.

The owners report the pump is giving excellent service. It is our knowledge that this pump possesses the quality that will command satisfaction that induces us to give the name of the owner just as we are constantly doing of a different installation each week in all our advertising.

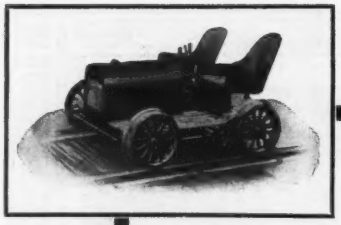
Catalog 132 describes about 50 styles of American Centrifugal Pumps. Write for it.

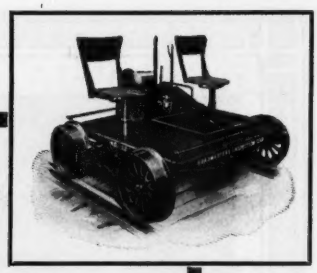
The American Well Works

General Office and Works: Aurora, Ill.
Chicago Office: First National Bank Bldg.

Sales Agencies

New York City	Kansas City, Mo.	San Francisco	Edmonton, Alta.
Philadelphia, Pa.	Joplin, Mo.	Salt Lake City	Calgary, Alta.
Pittsburgh, Pa.	Lincoln, Nebr.	Los Angeles	Chatham, Ont.
St. Paul, Minn	Denver, Colo.	Dallas, Texas	Montreal, Que.
St. Louis, Mo.		Artesia, N. Mex.	





ROADMASTERS

Start the New Year Right

RESOLVE: That you will make your inspection trips more frequent this coming New Year.

It is those frequent, personal visits to the various sections on your division that show you the "leaks" in track maintenance. You will find them much more effective than written reports because you SEE WITH YOUR OWN EYES how the work is progressing, you can SEE the necessary changes that must be made to improve the right of way.

THE NEW FAIRMONT FEATHERWEIGHT CAR

Is the lightest and most speedy little inspection car ever built. Just the thing for making those quick trips over the line.

It is equipped with two well-upholstered bucket seats of a new FAIRMONT design, the reliable FAIRMONT 2-cycle reversible engine (which runs equally well in either direction) and HYATT ROLLER BEARINGS. Comfort, economy and speed are all embodied in this—the last word in railroad motor car construction.

DON'T WAIT!

until the New Year rush is on. Your name and address will bring complete information concerning this and many other FAIRMONT INSPECTION CARS.

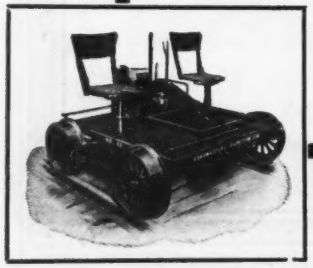
ANNOUNCEMENT

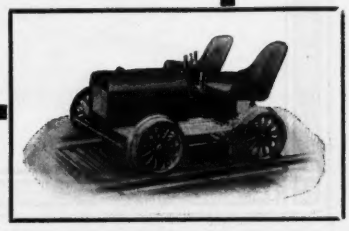
After January 1st, 1917, all FAIRMONT MOTOR CARS will be equipped with HYATT ROLLER BEARINGS. Another step toward higher efficiency.

FAIRMONT GAS ENGINE & RY. MOTOR CAR CO.

Formerly Fairmont Machine Co.

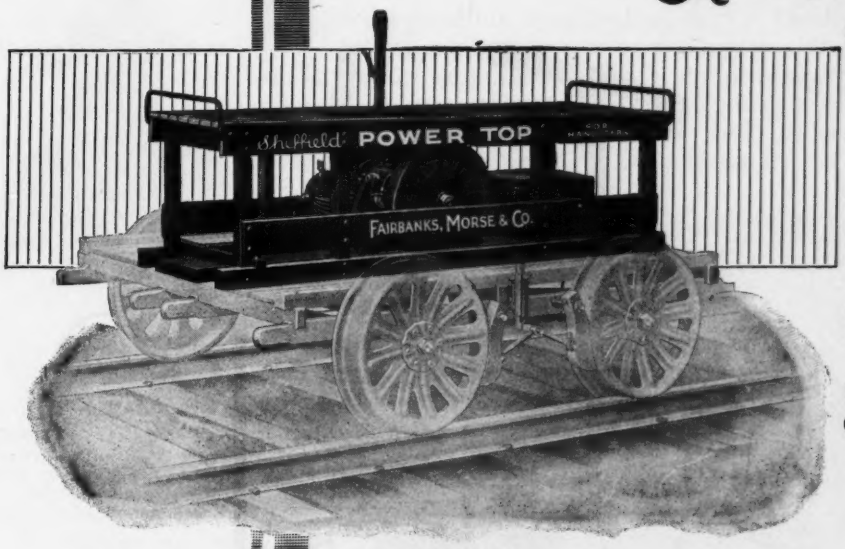
423 N. MAIN STREET
FAIRMONT, MINN.





Sheffield POWER TOP FOR HAND CARS

A complete outfit that changes any hand car into an up-to-date motor car—the only outfit that successfully runs on kerosene



$80.00 F.O.B. THREE RIVERS MICH.

—and it's

air cooled

A SHEFFIELD POWER TOP—the last word of experts who for years have designed railway motor cars and engines—will quickly change any hand car into a powerful Motor Car.

READ THESE FEW SPECIFICATIONS: 5 H. P.—air cooled—two cycle—three working parts—absolute speed control. No carburetor to be adjusted—no valves—no water to boil over on a hot day.

THE SHEFFIELD POWER TOP is a complete outfit—no additional material is required—a couple of hours' work and the hand car becomes a finished Motor Car. And a few minutes' time will perfect any man so that he can operate the engine and control the speeds.

We're Ready to Ship One or a Thousand

FAIRBANKS, MORSE & CO. CHICAGO

We have an illustrated folder which fully describes the New Sheffield. Write for it

The Big Gun

CEMENT-GUN COMPANY
INC.
SOUTH 10th AND MILL STREETS
ALLENTOWN, PA.

The Cement-Gun

For Big Economies

CERTAINLY, *for big economies in your Maintenance of Way Work*—sealing loose rock cuts, rust proofing and fire proofing bridge girders, protecting the underside of bridge floors from smoke, gases and blast action from passing trains, and those 101 concrete jobs which constantly confront every Maintenance of Way Engineer. No need to enumerate them to *you men who live with them*—those jobs which increase maintenance of way cost.

Big economies in such jobs is just what the

CEMENT-GUN

offers you. Isn't that what you want—*greater ease* and cheapness in doing your cement work? Then have what you want—get a Cement-Gun; it will soon prove to you that you need one for every Division so as to *secure the big economies it assures for your entire road.*

You owe it to your road, as well as to yourself, to secure both the economies of the Cement-Gun, and the lasting efficiency of its product

GUNITE

the product which defies the elements.

Remember! The Cement-Gun process automatically insures both an aggregate that is dense, homogeneous and waterproof, and a *money saving* which in the aggregate proves an important factor in lower maintenance cost.

Loose rock cut on N. Y. C. & H. R. R. R. sealed by the Cement-Gun. Weep pipes were left in the rock to drain off all entrapped water.

The Cement-Gun in Railroad Work. Prepared to get in action at the front.

Get The Facts

Cement-Gun Co., Inc.,
So. 10th and Mill Sts., Allentown, Pa.

I am interested in the Big Economies the Cement-Gun process effects in Railway Maintenance of Way Work.

Please send me full data, and facts, figures and pictures of Cement-Gun Work.

Name.....

Address.....

For Every Division

Bureau of Inspection

The Value of Special Inspection In Preventing Rail Failures

Statistics received by the American Railway Engineering Association from the various railroads of the United States and Canada for year ending October 31, 1915, make it possible to classify rails known to have been rolled under Special Inspection from those rolled without Special Inspection. A closer classification shows the total number of failures per 100 track miles, with and without Special Inspection.

Of all rails reported from the United States mills that have been rolled under Special Inspection there have been **19.6 failures per 100 track miles,** as against **27.4 failures on rails to which Special Inspection did not apply.**

Special Inspection Reduced Rail Failures 40 Per Cent

Special Inspection of rails means inspection applied to the whole process of manufacture and finish, while Ordinary Inspection consists of an examination of the finished rails to prove the accuracy of the section rolled, the mechanical finish and the final classification into first or second quality, etc.

We are the originators of Special Inspection, and our Bureau of Inspection, since its inauguration in 1912, has inspected **over 4,500,000 tons of rail** by this system.

Our service is to **assure** by courteous co-operation with manufacturer, dealer or selling agent a strict compliance with the specifications and, by stimulating delivery, a reduction of expensive delays.

Write for booklet describing our service for your Maintenance of Way Department.

Robert W. Hunt Jno. J. Cone Jas. C. Hallsted D. W. McNaugher

Robert W. Hunt & Co.

ENGINEERS

BUREAU OF INSPECTION TESTS AND CONSULTATION

2200 Insurance Exchange, CHICAGO 90 West Street, NEW YORK Monongahela Bank Building, PITTSBURGH
Charleston Building, SAN FRANCISCO Syndicate Trust Building, ST. LOUIS
McGill Building, MONTREAL Norfolk House, LONDON

Railway Maintenance Engineer

Volume 13 | January, 1917 | Number 1

(With which is incorporated the Engineering and Maintenance of Way Edition of the *Railway Age Gazette* and *Railway Engineering and Maintenance of Way.*)

Published on the last Thursday preceding the date of issue by the
SIMMONS-BOARDMAN PUBLISHING CO.,
TRANSPORTATION BUILDING, CHICAGO, ILL.

NEW YORK: WOOLWORTH BLDG. CLEVELAND: CITIZENS' BLDG.
WASHINGTON: HOME LIFE BUILDING.
LONDON: QUEEN ANNE'S CHAMBERS, WESTMINSTER.

EDWARD A. SIMMONS, *President.* LUCIUS B. SHERMAN, *Vice-President.*
HENRY LEE, *Vice-President and Treas.* M. H. WIUM, *Secretary*

ELMER T. HOWSON, *Editor.*
WALTER S. LACHER, *Associate Editor* JOHN G. LITTLE, *Associate Editor*

Entered at the Post Office at Chicago, Ill., as mail matter of the second class.

Subscription price, including the twelve regular monthly issues of the *Railway Maintenance Engineer* and the four daily issues of the *Railway Age Gazette*, published in connection with the annual convention of the American Railway Engineering Association: United States, Canada and Mexico, $1.00; foreign countries (excepting daily editions), $2.00.

WE GUARANTEE that of this issue 7,695 copies were printed; that of these 7,695 copies, 6,400 were mailed to regular paid subscribers, 95 were mailed to advertisers, exchanges and correspondents, and 1,200 were provided for new subscribers, copies lost in the mails and office use.

The *Railway Maintenance Engineer* has applied for membership in the Audit Bureau of Circulations.

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Review of Market Conditions

The present is a time of rapid changes in the prices of many materials used in the maintenance of way department. Because of these conditions it is extremely difficult for many men to keep in touch with the costs of many of the articles they are using and to determine the relative economy of alternate materials. While few engineers, supervisors or foremen purchase these materials directly, they do specify them, which is, to all practical purposes, equivalent to their purchase. It is, therefore, of more than passing interest that they be informed regarding price tendencies. For this reason we have included a general review of market conditions in this issue, and aim to make it a part of each number. We believe that this can be made of real service to our readers, many of whom are removed from the centers of industrial activities and, therefore, not in direct contact with such changes.

Urgency of the Foreman Problem

The discussion of the section foreman problem which appears on page 4 deserves the serious consideration of maintenance of way men, for it presents accurately the conditions existing on many roads. The statements that "very few young men are entering the maintenance of way department," that at times the writer of the article cannot "pick up a laborer competent to take charge of a section" and that some roads pay their foremen higher wages than generally prevail so that they can "draw their foremen from other roads," constitute a severe arraignment of present methods. Any organization which does not renew itself by attracting a sufficient number of capable young men to replace the older men as they leave the service is unsound. The tracks and structures must be maintained, and to continually higher standards. This requires the exercise of a higher degree of ability than ever before. Yet almost no attempt is being made to enlist and train new men in this service to maintain the strength of the organization. Conditions are serious to-day. If present methods continue to prevail they will be more serious five years from now. The problem requires the concentrated study of all concerned. It is possible of solution if those interested in it are willing to face the underlying causes squarely and to adopt the measures necessary to remove them. Railway men realize the conditions which exist in a general way, but the inertia is so great that they individually fear to tackle the problem. The same condition has existed for years with reference to changing the fiscal year. Maintenance of way men have long realized that the termination of the year in the middle of the working season constituted a serious handicap for them and that it ought to be changed, but they lacked the initiative and courage to undertake a campaign to secure the desired results and it remained for the Association of Railway Accounting Officers to carry the measure to a successful conclusion. No other organization will help the maintenance of way department solve its foreman problem, and it remains for the men in this branch of the service to work it out alone. Time is an important factor in its solution and no further delay should be permitted, for the problem is already acute. Each additional year only adds to the seriousness of the situation and makes the application of the remedy more difficult.

RECLAIMING BRIDGE MATERIALS

WITHIN the past few years there has come an increasing realization of the value of timber. This has been brought about not only because of its increasing cost, but also as a result of a greater realization of the extravagance with which it has been used. This has led to the more thorough utilization of small or second-hand timbers, such as bridge stringers, pile cutoffs, etc., materials being resawed for further use which were previously burned. The economies which a number of roads have effected in this way have been surprising and they can be duplicated on still other lines. Within recent years there has also been a greater endeavor to realize the largest possible returns from steel spans released from service under tracks. It has been common practice to transfer bridges from main to branch lines and to use them as overhead highway crossings. Frequently, however, they have been used for various other and ingenious purposes, either in their present form or after breaking them up. One road built the framework for a large shop building with material taken from several trusses. Another one supported the runway for a traveling crane in a shop on the vertical posts from a large span. To bring out instances of this sort and also information regarding the results which have been secured with the reclamation of timber we have announced a contest on The Reclamation of Bridge and Building Materials to which we invite contributions describing practices which have been developed, and proposed modifications for other improvements. These papers should include as much detailed information as possible regarding the methods followed, the amount and character of the materials reclaimed, and the savings effected. If photographs are available they will also be of value. Prizes of $25 and $15 will be paid for the two best papers presented, based upon the practicability and general application of the methods they suggest. All other papers accepted and published will be paid for at our regular space rates. Contributions should be sent to the editor of the *Railway Maintenance Engineer*, Transportation Building, Chicago, and must be received not later than January 10, 1917.

THE FISCAL YEAR CHANGED

THE maintenance of way department received the most valuable Christmas gift which could have been given it this year when the Interstate Commerce Commission ordered the fiscal year changed so that it will end on December 31 instead of June 30. While seemingly involving only a clerical change, this action removes a great handicap to the economical conduct of the work of this department. There has been a strong undercurrent of opinion among the men in this branch of the railway service that the fiscal year should be changed, but this sentiment has never been crystallized into concerted action. It remained for the Association of American Railway Accounting Officers to assume charge of the campaign, and credit for this step is due primarily to it and to the Interstate Commerce Commission, which issued the formal order.

All railway men, and particularly those in the maintenance of way department, are familiar with the interference which the termination of the fiscal year on June 30 has caused with the orderly conduct of maintenance of way work. Much of this work is strictly seasonal in character and can be done to best advantage between April 1 and November 1. Even under the best conditions this creates a peak load in this department with all the disadvantages of non-permanent employment of the labor, etc., that necessarily results. This season, short as it is, has been further reduced almost one-half on many roads by the practice of holding expenditures to the minimum until after June 30 in order to throw all charges into the accounts for the following year. This policy has added at least 25 per cent to the labor cost of the work affected. The results were particularly disastrous last year when a very serious shortage of labor existed.

Now that this handicap is removed there is no reason why the maintenance work for the approaching season cannot be so planned as to distribute it over the entire season to the best advantage. If the work is to be bunched at any time this should be early in the spring, for the present indications are that labor will be even more in demand next summer than it was last year and the roads first in the field will have the best chances of securing the forces they need. The men are also more efficient during the spring than in the hot summer months. Railway officers should grasp the opportunity to fill out their section gangs to the summer basis as early as work can be undertaken to advantage, to organize their floating or extra gangs for rail and ballast renewals and other heavy work as soon as possible and also to undertake the larger improvement work, such as the renewal of bridges, the reconstruction of stations, etc.

DECAY AND MECHANICAL WEAR

THE economy of a consistent policy of timber protection is demonstrated in a striking manner by the results which the Atchison, Topeka & Santa Fe is now securing, as described elsewhere in this issue. The reduction of the annual tie requirements by 650,000, or 17½ per cent, in the last ten years, while the quality of the timber has decreased and the amount of traffic increased, is a remarkable showing. Stated in another way, the Santa Fe is now securing twice the life from inferior, soft pine ties that is ordinarily secured from the average untreated white oak tie.

This has resulted from the following of a consistent policy of protection of the timber from mechanical destruction as well as decay, from the time it is cut in the forest until it is taken out of the track or structure. The treatment of timber to protect it from decay is excellent so far as it goes, and it is the first important step towards extending its life. The Santa Fe is the pioneer among American railways in the preservation of its ties and it has a larger proportion of treated ties in its tracks than any other road. As the economy of this practice is demonstrated only after the lapse of a period of time equal to the normal life of the timber untreated, the results are slow in appearing, but because of a long continued policy in this regard the Santa Fe is now securing returns which may be equaled on other roads, but which are not yet evidenced because of the recent date of the adoption of a comprehensive treating practice. The treatment of timber has increased greatly within the past few years, but the industry is still in its infancy, as may be shown by the fact that only about 35 per cent of the ties now being used are treated.

Treating timber with preservatives is, however, only half protecting it. Many roads have made the mistake of spending large amounts to increase the resistance of their timbers to decay, and then allowing them to fail at an early date from mechanical destruction. Any expenditure to increase the resistance of timber either against decay or mechanical wear without protecting it also against the other agent of destruction is money wasted. It has been the unfortunate experience of a number of roads that they have treated their timbers carefully, only to have them fail by rail cutting or similar abuse before the normal life of the timber untreated was secured. No

small part of the results which the Santa Fe is securing is due to the reinforcing of the treatment of the ties by the general use of tie plates. It is entirely probable that the not-far-distant future will witness the increased use of screw spikes on many roads to secure a still further decrease in the mutilation resulting from the ordinary cut spikes.

The problem now is to obtain a resistance to mechanical destruction equal to that offered to decay. When this is accomplished it will be practical to leave a still larger amount of preservative in the timber and still further increase its resistance to decay. Protection against the two forms of destruction must go hand in hand if the most economical results are to be obtained.

THE MASTER CARPENTERS' DUTIES

TIME was when the bridge supervisor's or master carpenter's force consisted almost entirely of carpenters. It is true that there were a few stone masons, some engineers to run pile drivers and a few mechanics to fit pipe and repair pumps for the water stations. The stone masons are gone except such as became concrete foremen. The bridge carpenters, however, will always be with us, for as long as trains run it will be necessary to have skilled pile driver crews to build the emergency trestles that may be needed at any time, even on the best maintained railroads. Men must always be available, also, who have that knowledge and judgment which comes with long experience, and that is necessary for the safeguarding of traffic while the falsework changes required for the building of concrete and steel bridges are being made.

However, with the increasing use of permanent bridges and the long-lived creosoted trestles a smaller portion of the bridge supervisor's forces is occupied with the renewal of frame and pile trestles. On the other hand, the small force of mechanics which formerly sufficed is gradually expanding with the increased complexity of railway maintenance. At one time the master carpenter was concerned only with the care of shingle roofs, but today he must be familiar with the laying, care and renewal of all kinds of special roofing. In place of the old-fashioned plank floor he must now be conversant with creosoted blocks, asphalt, concrete and other types of floors especially adapted to the various classes of service encountered on railway property.

The increasing number of reinforced concrete and mass concrete structures of many types requires another form of special knowledge on the part of the man who is responsible for their maintenance, for while such structures imply permanence there are many features which need attention. Expansion joints may be imperfect, waterproofing may require renewal and, moreover, the master carpenter should be familiar with the various special processes now available for the repair of such structures.

Under these conditions the master carpenter is called upon for the solution of many problems involving a high degree of technical or trade knowledge in many lines and must maintain and supervise a force of men skilled in diversified classes of work. This change has taken place so gradually that it has generally been lost sight of and the question arises whether the organization of bridge and building maintenance work has been adjusted to meet these changing conditions. One modification that has taken a considerable load from the master carpenters' shoulders on some roads has been the concentration of water service in an independent department or bureau. However, the scope of the bridge and building department still covers a wide field of increasing importance.

LETTERS TO THE EDITOR

IMPROVING THE FOREMEN'S POSITION

CHICAGO, ILL.

TO THE EDITOR:

It is not felt that the problem of securing men capable of filling the position of supervisor or roadmaster is as difficult as that of securing maintenance foremen, for the reason that men are or can be promoted from the engineering staff to these positions on many railroads. Generally these men are glad to obtain such positions, both for the experience offered and for the chance to demonstrate their ability and secure advancement to higher positions. This, coupled with the fact that there are always at least a few section and extra gang foremen of sufficient ability to justify promotion to the position of roadmaster, makes the problem of securing men for this position a comparatively simple one and not of serious concern.

The very fact, however, that men are so promoted from the engineering staff makes it all the more difficult to secure the interest of men qualified to become good maintenance foremen, and in spite of its importance this subject has not received the consideration which it warrants. It is only on a few railroads that anything has been done to improve the desirability of the position of maintenance foremen, or to make their work attractive enough to draw to the position men who are competent to handle the work, and justify promotion. A maintenance foreman connot be made in a day; like other positions, it requires time to qualify a man, and under present circumstances the monetary advantages to be gained when compared with other fields of work is not such as to make the position very attractive.

On the lines of this company we established some years ago what is called an "apprentice system." The better qualified men in section gangs on each roadmaster's district are appointed as track apprentices and, instead of being carried at the daily rate of pay, are placed on a monthy basis, which is increased at intervals. Under the instructions of the roadmaster and section foremen, these men are qualified for the position of maintenance foreman. At the present time we have 55 track apprentices on our lines, and a considerable number of our section foremen have reached their positions through promotion in this manner. This plan is also in vogue on other railroads, with more or less success. Generally speaking, however, when compared with other positions which such men are competent to fill, the rate of pay is not such as to attract the number of men required, or to fill the positions which are open to them.

With the improved track appliances and materials which are in use on modern railroads, as well as the improved track required on account of the weight and speed of trains, the necessity obtains for a higher grade of skill in maintenance than heretofore, and better men can only be secured by making the position attractive, and installing some system of promotion whereby such men can obtain advancement and increased compensation. Therefore, of prime importance is a graduated scale of wages on each roadmaster's district, the men to be promoted to the better paying positions on such districts as vacancies occur. Those who reach the higher paid positions should be understood as being next in line for the position of supervisor or roadmaster. It is the lack of such a definite plan of promotion that has deterred many

men well qualified to fill such positions from considering them.

After having established a system of this kind, then of next importance is the proper housing of the men and their families. Such homes should be made as attractive as is consistent with money expenditures and should be supplied to the foremen free of any rental charge. In many cases good men do not now accept positions at the more important points for the reason that the increased pay is more than offset by the increased cost of proper living quarters. Further, labor-saving devices, such as the substitution of motor cars for hand cars, and various classes of improved tools to lessen the physical effort of the actual work, will go a long ways toward improving conditions.

By proper application of these three main features it is believed that under normal conditions reasonably good results will be obtained in securing proper maintenance foremen. Fair treatment and good working conditions, and bonuses in the way of premiums for extra efforts, will go a long ways toward improving the situation. Accompanying this must be a rate of pay commensurate with the duties performed. To obtain proper results personal records must be kept of each man, and promotion should not be made in the haphazard fashion existing at present.

H. G. CLARK,
Assistant to Chief Operating Officer, Chicago, Rock Island & Pacific.

HOLDING TRACK LABOR

YATES CENTER, KAN.

TO THE EDITOR:

I have read the article in the December issue of the *Railway Maintenance Engineer,* on the training of young men for promotion. I agree with the writer of this article when he says, "The demand for trained and efficient foremen is a universal and pressing one, in all branches of the maintenance of way department," and that "there is almost an equal dearth of material from which to create supervisors and roadmasters." In my opinion he is also right when he says that the outlook for the future is even more discouraging for the class of men now being drawn into the service as laborers does not offer a promising field from which to recruit foremen. It has been suggested that the most logical remedy for this state of affairs would be through an apprentice course or training school. I understand that this has been tried to some extent on some roads, but it has failed, seemingly from lack of inducement for young men in the maintenance of way department.

I am not very familiar with conditions on eastern or northern roads, but I have been with one western road 24 years as a laborer, section and extra gang foreman and roadmaster, and in my opinion the apprentice system would not work with us, under the existing conditions. Very few young men are entering the maintenance of way department at this time, especially as track laborers, because there is so much other work at much better wages. We have probably two regular men to the section, who get work the entire year, but they are mostly middle aged or old men who are permanently located in small towns, have families, and prefer section work to other common labor such as they can pick up around the average small town. Some of them have worked on the section so long they imagine they could not do anything else. As a class they are faithful and ready to go when called upon, but they are not very resourceful or energetic, and in all probability they are getting about all they earn, although none of them are foremen. When we have a lot of extra work to do that requires a large force we are compelled to rely upon foreign labor (mostly Mexicans) or hoboes, and we have not been able to get that class when needed worst.

I have 22 sections, and there are times when I cannot possibly pick up a laborer that is competent to take charge of a section. Two or three roads in this part of the country work Mexicans altogether, but they have the foremen's wages up somewhat so that they figure on drawing their foremen from other roads. We are usually able to pick up a few white men early in the spring, but as harvest time approaches they drop out, and we soon find ourselves looking for Mexicans, hoboes or anything we can get. There is so much other work at better wages and under better conditions, that young men who are thrifty can make more money working by the day than they can as section foremen and they have practically no responsibility. Men get $2.25 for 8 hours on public work, such as pipe lines, paving gangs, good roads, etc. Farmers pay good wages with excellent room and board.

Other departments of the railroads also pay more wages, and offer better working conditions than are offered on the section, even as foremen. For example, an ordinary car repairer will get around 20 cents an hour and will draw as much money each month as the average section foreman, while he has no responsibility, no reports to make and no correspondence to answer. If he is called away from his regular boarding place he gets time and one-half for overtime and expenses from the time he leaves until he gets back to his headquarters.

Another thing that is attracting our young men is the train service, where they can make a few student trips and then go to work at better wages by far than a section foreman who has worked the best part of his life. Young men are also going into the yard service as switchmen at from $100 to $120 per month with but very little previous experience. Therefore I say that there is absolutely no inducement for a young man with any intelligence to enter the maintenance of way department of any railroad, as a track man, under the existing conditions. In my opinion the situation will be getting worse instead of better unless some inducement is offered to intelligent young men. With the high school facilities we have now we should and could be getting high school graduates in the track service if we could offer proper inducements. We might get along fairly well with the common labor situation as it is, if the foremen's wages were such as to induce young men to put in three or four years as track laborers with some show of getting something better.

I believe it would be economy for the railroads to pay their laborers $2 per day, and their foremen $75 to $80 per month, because I am confident that we could get a much better class of men. With the two-dollar men I believe it would not be long until we would have a man or two on every section who would be competent to run it, besides having a gang that we could depend upon to do things. I also believe that we should arrange to keep as many of these men the entire year as possible.

By cutting the day's work to 9 hours during the 3 winter months, and possibly losing some of the bad days, I believe the work could be economically arranged so that a great deal of it could be done at this season, especially in the middle and southern sections of the country. All fences, cattle guards, signs, etc., could be gotten in good shape, and out of the way of summer work. Bank widening and ditching, bolt tightening, gaging, driving down spikes, etc., could also be done during the winter. This would have a tendency to help the labor situation, because if a man has a steady job at wages that he can live on he will make a better man than one that is employed only part of the time.

C. AUGUSTINE,
Roadmaster, Missouri Pacific.

Ties Treated in 1905 in Track Near Chillicothe, Ill.

TIMBER PROTECTION ON THE SANTA FE

A Description of the Methods by Which the Tie Requirements of this Line Have Been Reduced 650,000 Per Year

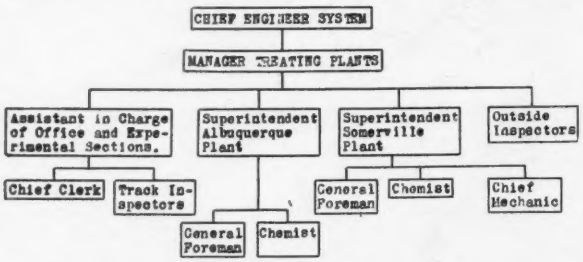
A REDUCTION of over 650,000 in the annual cross tie requirements for the last three years as compared with the demand on an equivalent mileage ten years ago is the unusual record which has been made on the Atchison, Topeka & Santa Fe proper. The annual renewals per mile of track for the three years 1913-1915, inclusive, were 191, as compared with 261 for the same period ten years previous. They decreased to 179 in 1914 and this figure would have been duplicated in 1915 had it not been necessary to renew 1,000 ties per mile of track on a road purchased that year to bring it up to the Santa Fe standard of maintenance. This reduction is equivalent to a saving of over $700,000 annually in the purchase and installation of ties alone. The full significance of the record now being made may be realized from a comparison with the average of 336 ties renewed per mile of track in all tracks in the United States as reported by the United States Census Bureau for 1911, the latest report available.

This record is all the more striking when it is considered that the ton mileage per mile of track has increased materially in this period. During this same interval the class of timber available for ties has deteriorated materially. The Santa Fe does not have access to the better grades of hardwood timbers and is forced to draw its supply of ties from the so-called inferior woods, the quality of which is deteriorating from year to year as the better grades of even this class of timber are becoming exhausted. The reduction in the tie consumption cannot be attributed to any policy of retrenchment for the expenditures for maintenance of way were well up to normal during this recent period and the track is in a better condition than ever before. The lines included in this comparison comprise the entire system of the Santa Fe east of Albuquerque and Belen, N. Mex., and north of Purcell and Shawnee, Okla., with 7,291 miles of main and branch lines and 9,552 miles of all tracks. This portion of the system only has been considered in the figures given above, as it is here that treated timber has been used most extensively and the results of the campaign of protection are most evident. However, the practices described below are also in general being followed over the Gulf lines.

This saving is the result of a long-continued policy of protection of the timber from decay and mechanical wear. The Santa Fe has been a pioneer in the preservation of ties, over 80 per cent of those in the parent lines and over 65 per cent of those on the entire system to-day being treated. It has also been a pioneer in the use of screw spikes having more in track to-day than any other western road, and, with the exception of the Delaware, Lackawanna & Western, more than any other road in America. It has bored and adzed more ties than any other road in the West, if not in the country. It has led in the experimental use of hard wood dowels, in soft wood ties, while it is the standard practice to use tie plates on all ties and over 60,000,000 plates are now in service. It is through these and similar measures that the road has been enabled to secure an average life of approximately 15 years from its soft pine ties.

The Atchison, Topeka & Santa Fe system comprises over 11,300 miles of main lines with 16,350 miles of tracks, extending from Chicago across the arid territory of the Southwest to Los Angeles and San Francisco and south to Galveston and the humid timber territory of eastern Texas. In this way ties in the track are subjected to a wide variety of climatic conditions while the density of traffic and grade and curvature conditions vary as on other roads. Approximately 4,350,000 ties are required annually, including approximately 600,000 for new construction. All ties are purchased, inspected and held in

stock by the stores department and all stock records, including those for timber at the treating plants, are kept under the supervision of this department. Beyond this point the treatment, distribution and protection of the timber are under the direction of the manager of treating plants who reports directly to the chief engineer of the system, but who necessarily also works closely in cooperation with the stores department. An exception to



Organization of the Timber Treating Department

this practice is made on the Coast Lines, where few treated ties are used and where the distribution is made directly by the stores department.

The Search for Ties

The Santa Fe was early forced to give attention to sources of tie supply, for its lines are almost wholly in a sparsely timbered country which produces few ties. No high grade hard wood forests are contiguous to its line and it has been forced to go to the soft inferior woods. At the present ime the largest part of its tie supply is secured from the southern pine territory of eastern Texas and Louisiana adjacent to the Santa Fe lines east of Somerville, Tex., and approximately 2,000,000 hewn and 1,250,000 sawed ties are purchased here. Approximately 700,000 ties are also secured each year along the lines in New Mexico and Arizona in the vicinity of Albuquerque, N. Mex., while 100,000 are secured along the line of the St. Louis, Rocky Mountain & Pacific in northern New Mexico, recently acquired by the Santa Fe. Approximately one-half of the ties required on the Phœnix lines, south of Flagstaff, Ariz., and Cadiz, are grown along these lines, while the rest are of Douglas fir shipped in from the Pacific northwest. Redwood and Port Orford cedar ties are inserted on the remainder of the Coast Lines.

Since the only ties available are now being secured on the remote parts of the system, the Santa Fe has made extensive investigations of the possibility of importing ties from foreign countries and also of protecting the ties in the track to secure the maximum life from them. As early as 1907 the manager of the tie and timber department spent eight months in a trip to the Hawaiian and Philippine islands, Japan, China, Australia, Manchuria and Korea to investigate possible timber supplies. On his way home he visited England, Germany and France, where he studied the methods of preservation and mechanical protection employed on the leading European railways. Later a second representative was sent to make further investigations of the tie-producing areas of Hawaii, Japan, Mexico, Venezuela and Cuba. Largely as a result of these investigations 6,000,000 ties were imported from Japan between 1906 and 1912, and were installed on the Coast Lines. About 700,000 Ohia ties have also been imported from Hawaii since 1908, and they are still being secured to the extent of about 125,000 annually, although the supply is limited and does not afford any hope of permanent supply. About 400,000 eucalyptus ties have been purchased, but the use of this timber has been discontinued, while approximately 16,000 hard wood ties were brought from Mexico. At the present time the possibilities of using the timbers of the Pacific northwest are being investigated carefully and while they do not lend themselves to treatment readily, recent experimental modifications of the common methods of treatment hold promise of making this timber available for use in large quantities, particularly as the foreign timbers have not proved satisfactory with the exception of the Ohia timber of Hawaii, the supply of which is limited.

Timber Preservation Facilities

With this scarcity of tie timber it is not surprising that the Santa Fe was one of the first roads to investigate timber preservation and has to-day followed a consistent practice of treating ties continuously for a longer period than any other road in this country. The first plant was built at Las Vegas, N. M., in 1885, and consisted of two cylinders. It was operated at a zinc chloride plant until it was dismantled in 1908, employing the Wellhouse method for about two-thirds of this time. A two-cylinder plant was built at Bellemont, Ariz., in 1898, which was burned in 1906. During the time it was in operation piling was given a creosote treatment and ties zinc chloride, using the Wellhouse method.

The largest plant on the system is the one located at Somerville, Tex., at the junction of the line tapping the tie-producing territory of eastern Texas with the main line to Galveston. A three-cylinder plant was built at this point by an outside corporation in 1897 and two more cylinders were added the following year. The plant was rebuilt with five cylinders in 1906 and was taken over by the Santa Fe Tie and Lumber Preserving Company, a

TIES INSERTED FOR RENEWALS IN MAIN AND BRANCH LINES AND MAIN AND SIDE TRACKS A.T.& S.F.RY.

Year	Miles main track	Miles of all tracks	Total ties in tracks	Total inserted for Renewals	Percentage of total ties inserted to total ties in track	Ties inserted per mile
1896	2,671	5,405	16,401,792	1,867,441	11.39	346
1897	2,570	5,339	16,181,440	1,611,509	9.96	302
1898	2,569	5,356	16,236,000	1,254,936	7.73	234
1899	2,688	6,171	18,585,952	1,290,282	6.94	209
1900	2,470	5,856	17,637,312	1,187,958	6.74	203
1901	2,469	5,900	17,759,456	1,075,041	6.05	182
1902	2,470	5,981	18,003,040	1,369,140	7.61	229
1903	2,654	6,135	18,524,352	1,470,286	7.94	240
1904	2,793	6,379	19,266,720	1,751,095	9.09	275
1905	3,306	6,989	21,164,932	1,869,233	8.83	267
1906	3,682	7,467	22,593,360	1,159,219	5.11	155
1907	3,545	7,427	22,522,324	2,067,651	9.18	278
1908	3,586	7,712	23,355,824	2,304,347	9.87	299
1909	3,714	8,041	24,391,488	2,355,540	9.66	293
1910	3,824	8,563	27,294,336	2,352,184	8.62	275
1911	3,698	8,872	28,270,420	2,335,796	8.26	263
1912	3,589	9,043	28,810,592	2,074,492	7.20	229
1913	3,679	9,168	29,208,992	1,818,205	6.22	198
1914	3,678	9,568	30,481,120	1,714,102	5.62	179
1915	3,676	9,552	30,422,416	1,879,897	6.18	197

Tie Requirements by Years

subsidiary of the Santa Fe. Previous to 1906 it had been operated for about half the time by the Wellhouse process, but since this date the Reuping process has been employed continuously except for a short time in 1915, when the plant was changed over to use zinc chloride because of the inability to secure creosote. In May, 1916, the plant was reconverted into a creosoting plant.

The Somerville plant was located as close to the source of timber supply as possible and at the same time secure

satisfactory seasoning conditions. Also from its location on the main line to Galveston it is possible to load a large part of the treated material for shipment north bound in cars which would otherwise move empty, thereby reducing the extra car mileage to handle the company material to the minimum.

With the exception of the interruption caused by the war creosote has been used exclusively as the preservative material at Somerville, piling and white oak ties being given the full-cell treatment and all other ties being treated by the Reuping process. By the latter approximately 5 lb. of oil is left in the timber. Because of the location of the Somerville plant close to the Gulf of Mexico and removed from the points of manufacture of domestic creosote, the oil used is imported. It is delivered at Galveston in tank steamers and a large reservoir is provided there for storage. The oil is hauled to Somerville in tank cars and two 600,000-gal. oil storage reservoirs are maintained at this point. A two-cylinder plant was built at Albuquerque, N. M., in 1907, at which the crude oil Reuping and Burnettizing processes have been used. On May 1, 1916, it was converted into a creosoting plant, the oil being hauled in tank cars from Galveston. This plant is convenient for the handling of ties originating on the lines north and south of Albuquerque as well as on the main line west through Arizona.

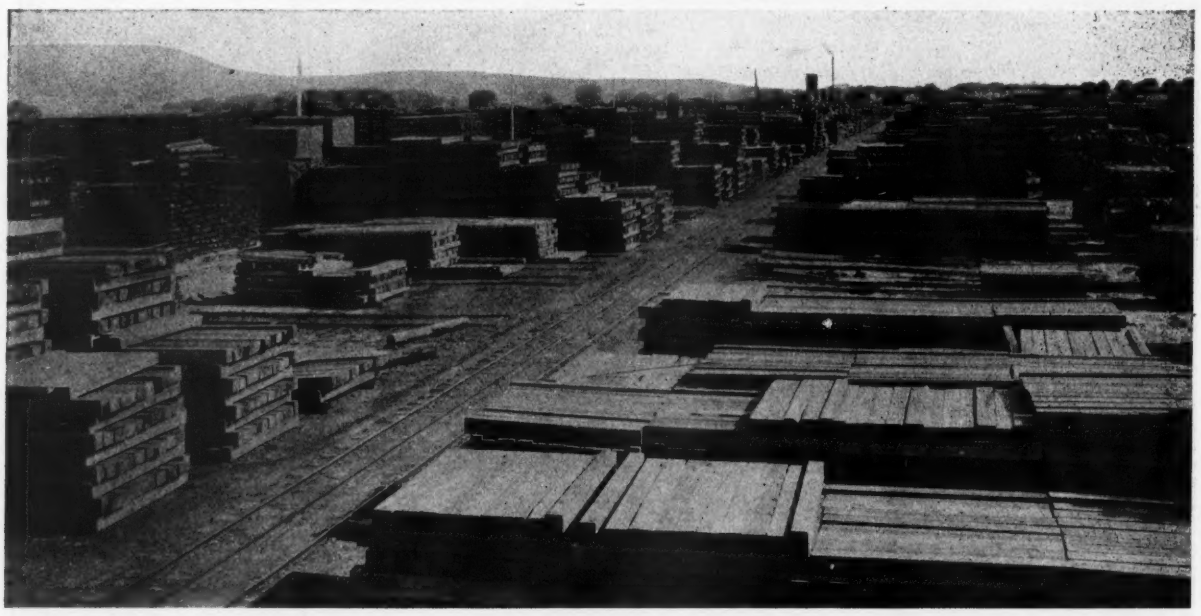
Both the Somerville and the Albuquerque plants are owned by the Santa Fe and are operated as company plants. About 250,000 ties are also treated annually at a commercial plant in southern Illinois, while the 100,000 ties secured along the line of St. Louis, Rocky Mountain & Pacific in northern New Mexico are treated at a commercial plant at Cimarron, N. M. Considerable quantities of ties are now also being treated more or less experimentally at commercial plants in Oregon and Washington and over 60,000 ties have already been secured from this source. From 1900 to 1906 considerable quantities of piling were also treated at a commercial plant at Beaumont, Tex., but this work is now all done at Somerville.

In the treatment of the timber particular attention is given to the quality of the oil used. Only the highest

END SECTION OF TIE DESTROYED BY SPIKE KILLING AND RAIL CUTTING (UPPER LEFT). PINE TIE EQUIPPED WITH HARDWOOD DOWEL AND SCREW SPIKE (UPPER RIGHT). TREATED TIES RUINED BY RAIL CUTTING UNDER LIGHT TRAFFIC IN SIX YEARS (LOWER LEFT). SCREW SPIKE TRACK BUILT IN 1910 (LOWER CENTER). TREATED LONG LEAF PINE AFTER 17 YEARS' SERVICE (LOWER RIGHT).

grade oils are purchased and each lot is sampled for water content as it reaches Galveston. Samples are also taken from each tank car and submitted to fractionation tests at the Somerville laboratory. The plant chemists also exercise supervision over the treatment given the ties at each plant, weighing the timbers in and out of the retorts, to determine the absorption and boring into them to determine the penetration. Company inspectors observe the same precaution when the timber is being treated at commercial plants.

It has been the general policy of the Santa Fe to use treated ties exclusively on all lines east of Albuquerque since 1910, except on two divisions near the Gulf of Mexico, where untreated cypress ties were used until two years ago, since which time treated ties have been inserted on these lines also. As a result, over 80 per cent of the ties on the parent line and at least 60 per cent of those on the system are treated at the present time. The Albuquerque plant treats and distributes ties as far east as Amarillo and Clovis, Tex., and Syracuse, Kan., while the Somerville plant supplies the requirements of the gulf lines and the Santa Fe proper east to Marcelline, Mo., east of which point the ties are secured from the commercial plant in Illinois. Up to December 31, 1915, 47,421,248 ties, 208,859,463 ft. B. M. of timber and 8,103,410 lin. ft. of piling have been treated by the Santa Fe in its plants. In addition over 3,000,000 ties have been treated at commercial plants.



Seasoning and Storage Yard at Albuquerque

Seasoning the Timber

Preliminary to the treatment of the timber care is exercised to see that it reaches the plant in good condition. Conditions in the timber areas in eastern Texas are particularly conducive to the quick decay of ties and piling. On one line built in this territory a few years ago untreated ties began to come out of the track in eight months and all had been removed in two years. For this reason, special precautions have been adopted to insure the prompt removal of the timber to the seasoning yard. All ties and piling are inspected and stenciled by the inspector while freshly cut and when he cannot satisfy himself of this fact, he does not accept the timber. Each piece of timber is marked with the month inspected and is stacked along the right of way in open piles, from which it is moved to the treating plant as soon as possible, but in all cases within three months. Sawed ties are shipped directly from the mill to the storage yard and are inspected there. For the economical handling of the ties which are cut throughout the year, 400 cars have recently been built of a special design as shown in an accompanying photograph. They are designed to facilitate the loading and unloading of the timber and to reduce the amount of labor required for these operations. When loading ties in these new cars an extra car is employed on which is mounted an electrically-driven winch, from which a cable passes through a series of sheave blocks to the right of way on either side of the car on which the ties may be piled. After being secured to a bundle of ties the line is drawn in and they are swung aboard the car. These cars are ordinarily moved to the treating plant in solid trains, although they are also used as far as possible to fill out regular freight trains.

On arrival at the storage yards, they are unloaded in a specially designed yard, which is thoroughly drained and in which special attention has been given to the cleaning up of refuse and timbers which might afford lodgment for decay which would spread to the freshly cut wood. These ties are stacked in 1:9 open piles to facilitate seasoning. Ordinarily about 1,250,000 ties are held in the yard at Somerville for this purpose, oak ties being commonly seasoned 12 months, gum 5 months and pine from 3 to 4 months.

The materials are piled in the yard systematically according to the dates cut, so that they may be treated at the proper time. Special care is taken to remove all bark from piling so that proper penetration of the preservative may be secured. Only long leaf timber is accepted for piling over 24 ft. long, but short leaf pine is also accepted for lengths less than 24 ft.

The Use of Cut-Off Saws

Until a few years ago it was felt that these precautions and the culling of all timber showing fungus were sufficient, but it was found that this did not remove all decayed material. Later it was thought that the presence of black spots on the exterior of the timbers could be re-

lied upon to indicate the presence of interior decay, but again this was found to be incomplete. As the injection of preservatives into timber in which decay is already well advanced, results not only in the loss of the money expended in the treatment, but in the early removal of the timber itself and the condemnation of the treatment, two cut-off saws have been installed at Somerville and one at Albuquerque by means of which ½ in. is sawed from each end of all ties other than oak, which are not subject to this form of interior decay. Likewise, the ends are sawed off enough piling by hand before they are loaded on the tram cars for treatment, to insure that the lot is sound and where they run bad the ends are sawed off each stick. In this way the seals formed at the ends of the timber are removed and an opportunity is secured to ascertain that the timber within is sound before it is treated. These cut-off saws reveal an average of about three per cent of the ties with interior decay, about one-half of which can be used for seconds. All of this three per cent detected in this manner show no exterior signs of decay, have passed the inspectors and would otherwise be treated.

ALL TIES ADZED AND BORED

The Santa Fe has also been a pioneer in the use of adzing machines, purchasing the first two built in this country in 1910. These original machines were mounted in cars, and although worked continuously their capacity was not equal to the output of the plant. Within the last two years two additional and more modern machines have been installed at Somerville and one at Albuquerque, while one of the earlier machines has been sent to the Coast Lines to adze untreated ties before their insertion in the track. Thus at the present time all ties used east of Albuquerque are adzed before treatment, insuring a full bearing for the tie plates and decreasing the cutting of the wood fibres, while the same is true of a large portion of those ties installed on the coast lines. This is of particular advantage with hewn ties which have more or less irregular faces.

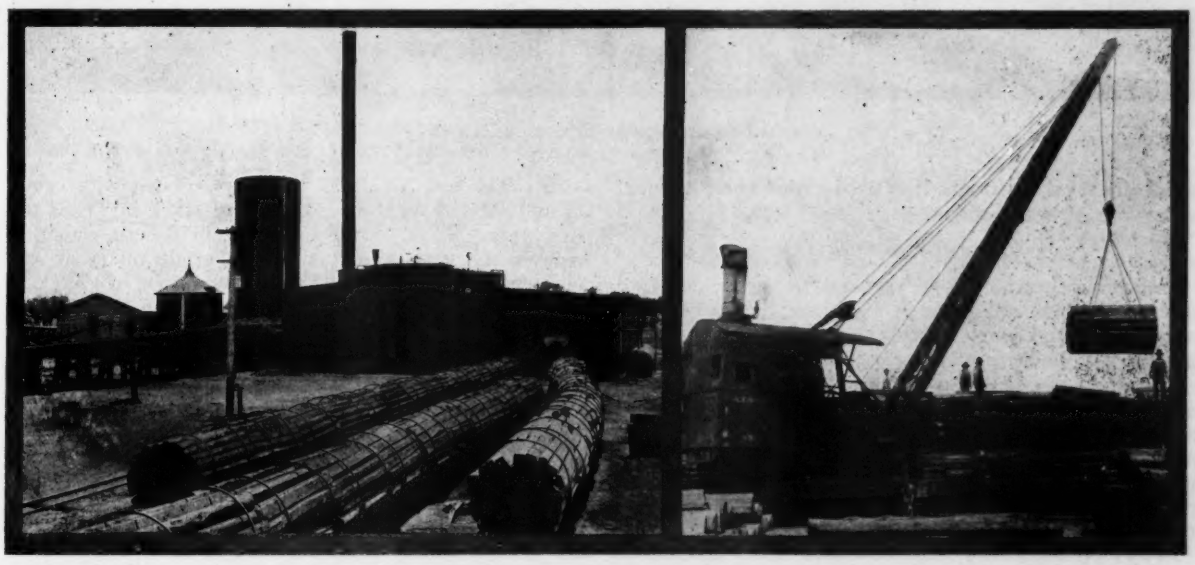
All ties passing through the treating plant are also being bored for spikes, while the machines going to the Coast Lines are equipped with the same attachment for boring untreated ties. A ⅜-in. hole is bored through pine and a 7-16-in. hole through oak ties. Two holes are now being bored in each tie, although four were formerly inserted and this practice will probably be resumed in the near future, as it saves turning a tie end for end when placing it in the track to conform to standard practice regarding spiking. The boring of these ties reduces the tearing of the wood materially, while tests have shown the holding power of a spike to be as great in a bored as in an unbored tie. By boring a hole through the timber an opportunity is provided for the oil to penetrate about the spike holes and under the tie plate where the tie needs protection the most. While passing through the adzing and boring machines the ties are also given a hammer stamp on one end, indicating the kind of wood and the rail section for which they are bored, and on the other end the month and year of treatment.

After being treated, the ties are held in the yard to season as far as possible. While this requires an additional handling, storage along the line has been found to result frequently in the use of the ties before they have had an opportunity to season sufficiently. Under ordinary conditions about 300,000 treated ties are thus held at Somerville. In addition to the 1,250,000 untreated ties ordinarily on hand at this point an average of 2,600,000 ft. B. M. of untreated and 1,500,000 ft. B. M. of treated switch ties are stored here in addition to about 10,000 sticks or 310,000 lin. ft. of untreated and treated piling and about 6,000,000 ft. B. M. of treated and untreated timber.

OTHER TIMBER TREATED

In addition to ties, all piling used east of Albuquerque is treated at Somerville, being given the full cell creosote treatment except where it is to be used for temporary work when it is given the Reuping treatment. Practically all of this piling is secured from eastern Texas, the annual requirements being about 1,000,000 lin. ft. All piling and lumber used on the Coast Lines is treated at commercial plants in the Northwest.

In addition to ties and piling over 12,000,000 ft. B. M. of lumber is treated annually at Somerville for various maintenance of way purposes. The Santa Fe has been a pioneer in the use of creosoted ballast deck trestles, 2,006 such structures, with an aggregate length of 217,-784 ft. having been built since 1899. Including other structures to which this type of deck has been applied, the total length of ballast deck structures is 333,757 lin. ft.

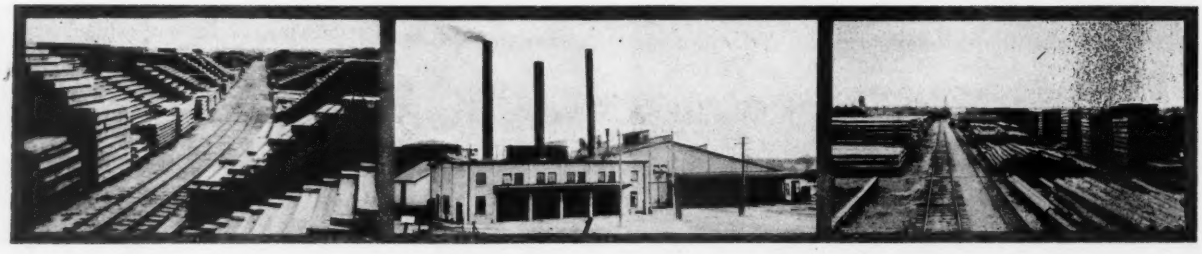


TREATING PLANT AT ALBUQUERQUE. LOADING TIES WITH A LOCOMOTIVE CRANE

This form of construction is standard for use on main lines, while creosoted open deck structures are built on branches, 6,411 such structures aggregating 582,265 lin. ft. now being in service. Large quantities of timber are also treated for crossing planks, stock pen posts, drain boxes and filler blocks for Weber joints. A small saw mill is provided at Somerville, at which timbers are cut to dimensions before treatment, and this practice is being increased.

All ties are unloaded, stacked and loaded at the treating plant by piece work, while three locomotive cranes are employed at Somerville to handle piling, switch ties and large dimension timbers. A standard gage switch engine works continuously at the tie plant, switching road cars about the plant. Including piece work employees, a total of 250 men are normally employed here.

As over 75 per cent of the ties now in track in the parent line are of the soft woods, it is essential that they be protected from crushing and rail cutting if the full benefits are to be secured from the treatment. As a result, tie plates have been used in large quantities, over 60,000,000 now being in service. It has been the standard practice to use tie plates on all ties in main and branch lines and in side tracks alike since 1910, although this standard has not been adhered to in all cases. The standard tie plate is 7½ in. by 9 in. in area and ½ in. thick with two small ribs on the bottom. It is used with a chisel-pointed spike with a 9-16-in. shank.



VIEWS OF THE SOMERVILLE PLANT

SCREW SPIKES AND DOWELS USED

Following the visit of the manager of the tie and timber department to France in 1907, the Santa Fe management became convinced of the desirability of protecting its ties more fully from mechanical destruction to give them a resistance against this form of deterioration equal to that against decay. As a result it undertook extensive experiments with screw spikes and now has about 375 miles of screw spike track in service. The first extensive installation was made on the Hutchinson-Kinsley cut-off in western Kansas in 1910, and consisted of 30 miles of track to which screw spikes were applied out of face and 25 miles on which they were inserted in ties spotted in. All of the sections are still giving excellent service. Other large installations have been made on new second track constructed four or five years ago on the Coast Lines, where large numbers of screw spikes were inserted in Japanese oak ties. While a considerable number of these ties are now coming out of the track, their failure has not resulted from spike cutting. The present practice on the western lines of the parent system is to insert eight screw spikes per panel in heavy tie renewals to strengthen the track.

A further step along this line has been the insertion of hard wood dowels in soft wood ties, thereby securing hardwood ties, as far as their resistance to spike killing is concerned. These dowels were applied to approximately 15,000 ties inserted in the screw spike track between Hutchinson and Kinsley in 1910, all of which are giving satisfactory service. The management has given authority recently to apply 200,000 additional treated dowels to 50,000 new ties and this work is now in progress. These dowels are being placed in loblolly pine, redwood and cedar ties, all of which are timbers which otherwise offer a limited resistance to spike killing. Treated Beech dowels are being inserted in the ties which will be placed in the eastern lines and Ohia dowels in those used on the Coast Lines. It is estimated that the application of these dowels will cost 14 cents per tie, although in larger quantities it is expected that they can be reduced to 10 cents per tie. These various measures are being adopted since the problem still is to protect the ties against mechanical abuse. At the present time only five pounds of oil is left in timber but if full protection could be secured against mechanical wear they could be given a seven-pound treatment and the resistance to decay increased still further.

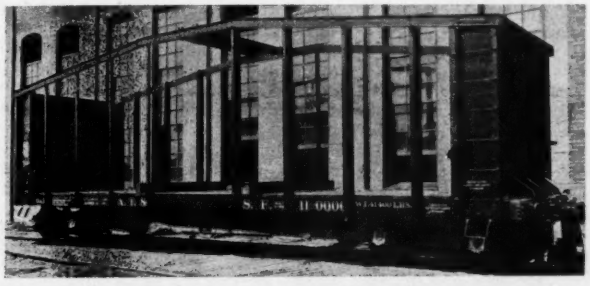
In addition to protecting the ties from mechanical wear a great deal of experimental work has been done with different preservatives with the hope primarily of decreasing the cost of the treatment. Particularly extensive tests have been conducted with crude oils from the Mexico, Texas, Kansas, California and Oklahoma fields. The first lot of 12 ties were treated with crude oil in 1902 and were placed in a test track in Texas the same year. Based on the service secured here, elaborate experiments were undertaken with crude oil in an experimental cylinder provided at Albuquerque in 1906, and up to 1914 approximately 1,500,000 ties had been treated with various grades and mixtures of these oils. The more extensive use of this material led to results which were less satisfactory than the first test had led the road to expect, and it has since been discontinued.

DISTRIBUTION OF THE MATERIALS.

In a system the size of the Santa Fe there is certain to be a wide variation in the climatic, traffic and other service conditions to which the ties are subjected. For this reason, the distribution of the ties over the different lines is receiving close attention and the following regulations of recent enactment are now in effect. On main line curves of 3 deg. and over only oak and long-leaf pine ties are used; while long-leaf pine ties are used on main line tangents and curves up to 3 deg.; loblolly pine ties are used on branch lines and second-class ties in side and passing tracks. In placing requisitions with the treating plants the store department gives the character of the track in which the ties are to be used and the weight of the rail for which they are to be bored. To have ties available for use as needed at points nearer than Somerville and Albuquerque intermediate storage yards have recently been established at several points on the system from which hurried orders for ties from the dif-

ferent divisions can be filled. A considerable quantity of lumber is also held in stock at such a yard at Arkansas City, Kan.

An important feature of the work of the timber preservation department has been the undertaking of a campaign of education to impress upon those using timber the importance of handling it properly to avoid the unnecessary cutting of the treated surfaces, thus rendering the preservative ineffective. For this purpose liberal



ONE OF THE NEW TIE CARS

use has been made of photographs and all instances of abuse which have been detected have been followed down. In many instances relief has been secured by correspondence direct with the parties at fault. Opportunity has also been taken to present this subject to groups of employees at division headquarters, etc.

COLLECTION OF SERVICE STATISTICS

With the care which is being taken to protect the ties from attack by agents of decay and mechanical wear, it is essential that accurate information be compiled showing the extent to which this is successful. Prior to 1910 an attempt was made to keep a record of all ties inserted and taken out of track on the entire system, by inserting a dating nail with a round head in every treated tie and one with a square head in each untreated tie and requiring the foremen to make reports of all ties put in or taken out of track. This system, however, proved too cumbersome and inaccurate to be practical.

It was then decided to select one section of track on each division superintendent's territory over the system, typical of conditions on that division and to collect accurate records on the section. Twenty-five such test sections, aggregating about 150 miles of track has since been selected and are under observation. These sections were not re-tied out of face but a careful record has been kept of each tie inserted under normal service conditions and all removals studied to determine the cause. It is required that all ties taken out of these sections, the limits of which correspond with those of the section foremen, be held for inspection by representatives from the office of the manager of treating plants before being destroyed. In addition a detailed inspection of all ties in these special test sections is made annually by inspectors working under the direction of the assistant to the manager of treating plants having charge of experimental sections. These inspectors also detect irregular or inaccurate reports and by their close supervision secure a more accurate record than was possible under the previous system. To show what the test sections are accomplishing a summarized report is made annually to the manager of treating plants.

All reported failures of treated materials including piling are investigated by inspectors of the timber preservation department who make special trips to locations of these failures if necessary. As a result of this practice it has been found that many such reported failures have resulted from other causes and frequently it has been found that the timber in question has never been treated. In addition to correcting the records in this way information is secured first hand regarding failures of treated timber correctly reported which is of service in correcting defective practices and in detecting new forms of failure.

Thus although over 75 per cent of the ties inserted in the track during the last 10 years are of the soft pine timbers, principally loblolly pine, which does not last over 4 years untreated, an average life of over 15 years is now being secured and the normal renewal per mile of track has fallen to considerably less than 200, as compared with 336 for the country as a whole. As a concrete example of what is being accomplished a section of track 66 miles long, on the Emporia cut-off, laid out of face with new ties in 1906, was re-laid with new rail in 1914 without renewing a single tie. In another section in Illinois laid with pine ties treated and inserted in 1904, the only ones removed to date have been those which have been taken out for exhibit. Instead of the annual requirements being reduced by 650,000, it is confidently expected that this reduction will be increased by 150,000 more when the entire lines are provided with treated ties.

The methods described above have enabled the Santa Fe to utilize, to the fullest extent, the available timber on its own lines. Although more than 50 per cent of its supply is loblolly and jack pine, among the poorer grades of tie timber in the United States, careful methods of inspection, from the tree, through the track to the scrap pile, good treatment, machining and mechanical protection have succeeded in securing over a continuous period of 20 years an increase of approximately 50 per cent in their life, as compared with that secured from the average untreated white oak, which is generally considered to be the best native tie to be had. This shows what can be done with the poorest grades of timber, and points out, in a forcible manner, what should be done with our better grades, which are just as susceptible to improvement.

The improvement that has been secured is only the beginning of what can be done if the right kind of care and mechanical protection are adopted. With the close co-operation of roadmasters and section foremen on the one hand, and executive officers who have the disposition of money for improvements on the other, even greater results can be expected in the future.

We are indebted to George E. Rex, manager of treating plants, for the opportunity to secure the information obtained in the above article.

TRANSPORTING TIES BY WATER

IT is the policy of the Lehigh Valley to purchase all the available ties from timber cutters along its own line, but as approximately 800,000 ties are annually required by this railroad, the local supply is never adequate to fill the demand and by far the greater part of the supply is secured from the yellow pine forests of the south Atlantic states. The transportation of these ties from the source of supply to the line of railroad is a serious problem and ordinarily both rail and water facilities are used. During the present year much difficulty has been encountered in securing vessels and this, coupled with the high water rates, even when boats were obtainable, has further complicated this transportation problem.

The Lehigh Valley met this situation by sending the sea-going tug, Perth Amboy, south with a tow of three barges which were loaded at Brunswick, Ga., and Jacksonville, Fla., with 50,000 ties. The return trip was made without difficulty.

TILE DRAINAGE ON MISSOURI PACIFIC*

By W. C. CURD,

Drainage Engineer, Missouri Pacific.

BETWEEN 1905 and 1911 extensive use was made of vitrified tile for draining water pockets and wet cuts on the Missouri Pacific System. During this period approximately 714 locations were worked in the following states:

Kansas	417
Missouri	180
Arkansas	80
Colorado	21
Oklahoma	10
Nebraska	4
Louisiana	2

Of this total about 79 locations, or 11 per cent, were reported as failing to give benefits, with but two causes of failure assigned: (1) Tile not placed to sufficient depth and (2) tile not placed in proper location. On this account and to determine the value of tile drainage for roadbed, a thorough investigation was made.

In the conduct of the investigation locations were selected for examination where grade, soil, rainfall and other conditions varied widely. At 70 locations the drains were uncovered at two or more points and examined for line, grade and signs of clogging. In the stretches of track inspected the drains varied from 100 to 3,000 ft. in length and were at depths of from three to seven ft. below base of rail.

The investigation showed a remarkable benefit to have been derived through the strengthening of the roadbed where drains had been properly installed and estimates made from most reliable information obtainable indicate a return of from 50 per cent to 200 per cent per year in the decreased cost of maintaining line and surface on the short pieces of track which were drained.

The failures reported were found to be due principally to improper installation, particularly with reference to the depth of drain to the moving material in the roadbed. In these locations many of the drains were forced to the surface and completely filled. In those locations examined where proper methods of installation had been followed, the line and grade of the tile was intact and entirely free of sediment or evidences of clogging.

Generally speaking, the writer does not believe it can be found that tile drains will produce a direct saving in dollars and cents in track maintenance, but the benefit would seem to lie in the development of more efficient track in locations where it was formerly found to be impossible to maintain good track. The benefit comes from the removal of slow orders and a more even distribution of the time of the section forces over their territory. In some cases it has resulted in an actual decrease of section forces, but this is the exception rather than the rule.

The necessity for tiling cuts comes from neglect to provide and maintain adequate surface drainage. The change is gradual and is not always noticeable until we are confronted with the result. Just as efficient if not better track could be developed if cuts were protected by intercepting and side ditches properly constructed and maintained, but tile seems to afford the only practical relief where the roadbed has become water soaked and too soft to sustain the loads.

Conclusions drawn from our experience indicate if tiling be installed in accord with the following requirements, the greatest permanency and benefit will be assured:

Drains should be laid with bell end vitrified salt glazed sewer pipe of a minimum diameter of 6 in., with unsealed joints.

The top of the tile should be placed one foot below frost line and a minimum distance of one foot below unstable or moving material. The depth in each case should be carefully determined by test holes or inspecting excavation.

Tile should be laid to grade established by level and with all the fall obtainable.

The location of the center line of tile should be parallel to and from 4 ft. 6 in. to 7 ft. from the center line of track.

Tile should be placed directly on the bottom of the trench. After it is laid to line and grade, and before backfilling, it should be covered with straw, grass or some such material to prevent loose particles in backfilling from entering the joints.

Trenches should be backfilled with cinders, with the coarse material placed directly around and over the tile. Where the walls of the trench show signs of distortion from passing loads, a sufficient quantity of riprap or coarse stone should be mixed with the cinders to brace the walls.

Pockets under the track should be tapped with cinder-filled lateral trenches, and connected into a tile drain trench, but without the connection with the tile drain except through the unsealed joints.

Remove all surface water from cuts by intercepting and side ditches, otherwise the tile drain may be overtaxed and eventually fail entirely.

After drains have been installed, it is essential to maintain free outlets to prevent backing water into the tile.

The ends of the drains should be surrounded and supported by concrete or dry masonry to guard against underwash.

To prevent small animals from entering tile, the outlet should be protected by rods or grating.

Failures of drains come from the following causes:

Insufficient depth below moving material.

Shifting grade or alinement causing joints to open.

Insufficient grade to provide proper flow.

Location of the drain in impervious material without providing adequate means for tapping the saturated material with lateral drains or cross trenches.

Distortion of walls of trenches.

Tile drainage is not a panaccea for all wet cuts and its use is not recommended without a complete knowledge of the conditions to be corrected. When these are known and proper methods of installation are applied, much benefit is reasonably sure to follow.

*From Bulletin 189 of the American Railway Engineering Association.

WOOD PRESERVERS' CONVENTION

THE Thirteenth annual convention of the American Wood Preservers' Association will be held at the Hotel Astor, New York, on January 23 to 25, inclusive. The following is the program so far as it has been arranged:

Tuesday, 10 a. m.

Address of Welcome.....Mayor John P. Mitchell
President's Address.....Carl G. Crawford
Reports of Officers and Communications.

Tuesday, 2 p. m.

Reports of Committees:
Publicity, Promotion and Education...E. A. Sterling, chairman
Service Tests of Ties and Structural Timber
.....C. P. Winslow, chairman
Terminology.....J. B. Card, chairman
Illustrated Talk—The Bad and the Good in
the Handling of Wood.....J. H. Waterman

Wednesday, 10 a. m.

Reports of Committees:
Plant Operation.....A. L. Kuchu, chairman
Preservatives.....E. B. Fulks, chairman

Wednesday, 2 p. m.

Paper, Grouping Woods for Preservative Treatment.....
.....C. P. Winslow
Report of Committee:
Purchase and Preservation of Structural Timber
.....A. B. Joyce, chairman

Evening

Informal Banquet at 6:30.

Thursday, 10 p. m.

Reports of Committee:
Service Tests of Wood Block Paving.C. H. Teesdale, chairman

Thursday Afternoon

Business Session.
Election and Installation of New Officers.

THE CORRECT DESIGN OF SPLIT SWITCHES

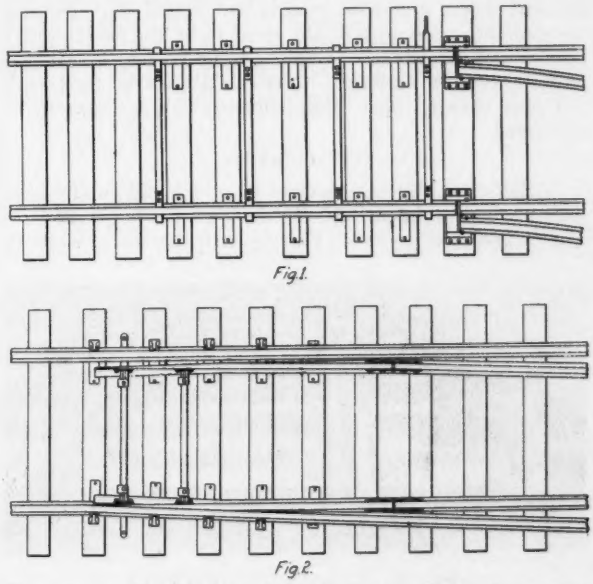
The Second of a Series of Articles Discussing the Problems of Construction of Special Track Work*

BY H. F. HEYL
William Wharton Jr. & Co., Easton, Pa.

SPLIT switches were first introduced in England in 1825. They are now almost universally used. In the United States they are made exclusively of tee rails, while in some European countries they are either planed or forged from billets or rolled special shapes.

The first switch brought into use was the stub switch (Fig. 1). It made a through track, whether set for the straight line or for a siding. Its principal objectionable features were the danger of derailment in case of an open switch with the train approaching from the frog; the frequent settling of the head-block owing to the pounding of the wheels; what was called a "tight switch," brought on by the expansion of the rails in hot weather; creeping of the rails, and that no matter how the switch was set, it always left an open joint.

The next step was the split switch (Fig. 2), in which two rails of the switch were produced to a fine point. A train coming in either direction, whether traveling on the main line or on the siding, has to pass over one of these points. A somewhat different type of switch is the Wharton unbroken main line switch (Fig. 3), introduced about 1860. As its name indicates, both main track rails remain unbroken and the switch stands entirely clear of the main track. When thrown for the siding, the treads of the inside wheels which overhang the head of the main rail are raised on an incline by an elevating switch rail until the flange of the wheel can pass over the head of the main rail; on the other side the switch point guides the outside wheels into the siding. As the switch is entirely clear of the main line when not in use, it is subject to very little wear. While this type of switch has obvious advantages, principally because it gives an unbroken main line, there exists the objectionable feature that it is not desirable for high speed trains at junctions, as the wheels of the train have to be lifted over the main rail. The now most generally used type is the split switch.



FIGS. 1 AND 2—DRAWINGS OF STUB AND SPLIT SWITCHES

BENDING AND PLANING

The method of bending and planing switch rails and the shaping of the point have been under discussion ever since the split switch was introduced. The rail from which the switch point is formed is usually bent horizontally so as to bring the stem or web of the rail directly under the extreme point. It is further bent or cambered vertically so that a portion of its base flange is preserved to pass over the base flange of the main or stock rail and to rest upon supports. Furthermore, it is bent vertically so as to bring the top of the switch rail somewhat above the main or stock rail to facilitate the passing of hollowed-out wheel treads with the so-called false flanges over and across the head of the main rail.

FIG. 3—THE WHARTON SWITCH

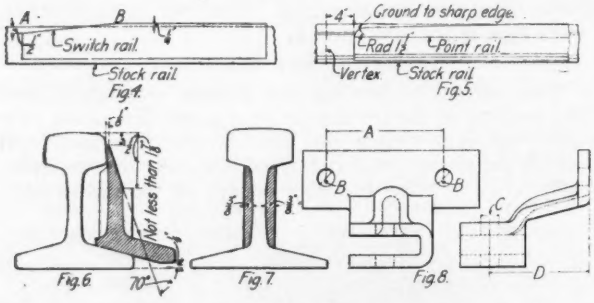
Most of the larger companies have their own drawings covering these points, with some variations in the details, but there is no reason why these features cannot be standardized. The same thing applies to the spread at the heel of the switch and the throw at the point. At present almost every road has a different spread. For example, the Pennsylvania Railroad specifies 5¾ in. for all its switches; the B. & O., 5½ in. for 11-ft. and 13-ft. and 6½ in. for 15-ft, 16½-ft., 24-ft. and 30-ft. switches; other companies have different spreads for every different length switch. The American Railway Engineering Association recommends a spread of 6¼ in. for switches of all lengths, which is ample to allow the easy fastening of any style of joint-plate. There is no reason why this could not be adopted as standard by all roads eventually.

The throw of the switch is not so variable. Most companies require 5 in. and this is also recommended by the American Railway Engineering Association. This association recommends the following for the planing of the switch rail:

"Side planing and bending shall conform to a spread at the heel of 6¼ in. between the gage lines of the stock rail and the switch rail, and a thickness of ¼ in. at the point. The bending and planing shall be done so as to give a straight gage line to the switch rail. The switch

*The first paper of this series appeared in the *Railway Maintenance Engineer* for December, 1916, page 369.

rail shall afterward be ground down to a thickness of ⅛ in. at the point, beginning 2 ft. back from the point of the switch; the point of the switch shall then be ground down to a sharp edge with a radius of 1½ in. The head of the switch rail shall fit neatly against the head of the stock rail from the point of the switch rail to the point of divergence. The inner edge of the head of the stock rail and the outer face of the web of the switch rail at the point shall be in the same vertical line when the switch rail is fitted against the stock rail."



FIGS. 4, 5, 6, 7 AND 8—SWITCH PLANING AND ATTACHMENTS

The top planing shall conform to the measurements shown in Fig. 4 and the following table:

Switch	Dist. AB
33 ft.	12 ft.
22 ft.	9 ft.
16 ft. 6 in.	7 ft.
11 ft.	5 ft.

The point of switch rail shall be as shown in Fig. 5. The distance "A" shall be:

5½ in. for 11 ft. 0 in. switch
8¼ in. for 16 ft. 6 in. switch
11 in. for 22 ft. 0 in. switch
16½ in. for 33 ft. 0 in. switch

Fig. 6 shows a section about 1½ in. from the point.

It will be noted that the top of the switch rail is carried on the same level above the main rail from the planed-down point all the way back to the heel. This requires stepped slide plates for the entire length of the switch rail and graduated thicknesses of tie-plates even beyond the heel. In most designs the switch rail returns to the general level within its own length by a vertical bend. This appears to be more practical and economical than the method described above.

INFORMATION REQUIRED BY A MANUFACTURER

Unless a railroad has standard plans of its own, the following information is absolutely necessary to build a switch:

(1) Length of the switch.
(2) Rail section.
(3) Drilling.
(4) Throw of the switch.
(5) Spread at the heel of switch.
(6) Kind of switch wanted, whether with or without reinforcement; whether rigid, adjustable or insulated.

If the switch is to be curved, it is necessary for the manufacturer to know the hand of the switch and the curvature. A switch is right or left handed, according as the turnout is to the right or the left of a man standing on the main track and facing the switch. The tendency is to make the switches straight wherever possible.

LENGTH AND REINFORCEMENT

Switches are usually made in standard lengths of 10 ft., 12 ft., 15 ft., 16 ft. 6 in., 18 ft., 20 ft., 24 ft., 30 ft. and 33 ft. Fifteen-foot switches are the most popular. This length was originally based on a 30-ft. rail, one rail making two switch points. Since then the standard rail length has been changed to 33 ft., creating a 3 ft. piece of scrap in the cutting of every switch. Consequently new lengths are being adopted, namely, the 11-ft., 16-ft. 6-in., 22-ft. and 33-ft. length switches, for the economical utilization of the prevailing lengths of rail.

Switches 15 ft. and 16 ft. 6 in. long are generally used with No. 6 and No. 8 frogs, 18-ft. and 22-ft. switches with No. 10 and No. 12 frogs, 30-ft. and 33-ft. switches with No. 15 and No. 20 frogs. Switches below 15 ft. are seldom used on main line traffic.

To strengthen the switch point rail and as a safeguard in case of fracture, a rolled steel bar ⅜ in. thick and rolled to fit standard rail sections, and placed along the web of the switch rail, as shown in Fig. 7, is quite generally used.

Switches 18 ft. or longer are almost all reinforced to within 15 in. or 18 in. of the end of the rail, depending on the length of the angle bar used. All main line switches should be reinforced. Fifteen-foot switches are generally reinforced the length of the planing, while in 10-ft. or 12-ft. switches it depends on conditions. Double reinforcement, that is, a bar on each side of the web of the rail, is preferred to the single reinforcement of only one bar, which may be on either side of the web.

There is no settled method of attaching the bars. Many roads require them to be riveted, while others insist on their being bolted. For instance, the Pennsylvania Railroad, the Southern and the New Haven have them riveted, while the Baltimore & Ohio and the Philadelphia & Reading have them bolted on. On some roads, while the reinforcement bars are riveted, other fastenings, such as sockets, stops, and foot guards are bolted on. Bolting the reinforcing straps would seem to be the better practice, as the threads of the bolts can be riveted or mashed and so act as a nutlock. Bolts can always be tightened, whereas rivets, once they become loose, cannot be tightened.

ATTACHMENTS

Sockets and clips are devices by which rods or tie bars are attached to the switch. In the East the tendency is to use forged steel sockets (Fig. 8), with flat bars, while in

FIG. 9—A SPRING ADJUSTMENT

the Middle West and West clips are used, the rods having jaws forged on both ends. It would appear that the method of using the sockets and flat bar as adopted as a standard by most roads in the East is more economical and more easily adjusted and renewed, as it consists of only two forgings and a flat bar. There is no reason why this method could not be adopted as a standard in the Middle West and West.

In detailing sockets on any railroad company's plans, the dimensions required by a manufacturer are:

(1) Distance center to center of holes for attaching sockets to rail (A).

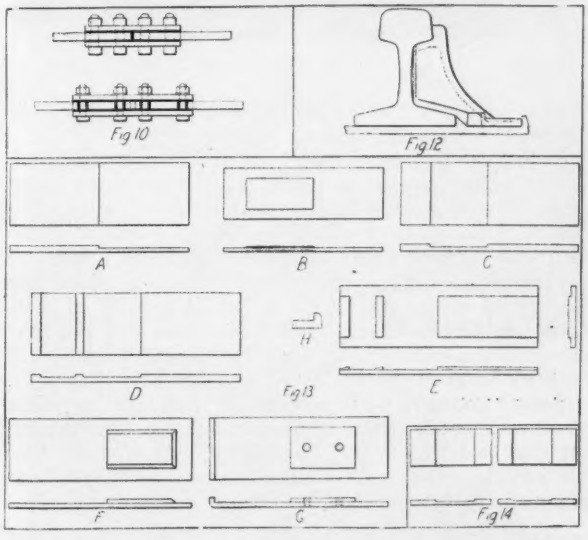
(2) Diameter of holes for attaching sockets to rails (B).
(3) Diameter of rod bolt (C).
(4) Distance from web to center line of rod bolt (D).
(5) Height of socket holes from base of rail.
(6) Thickness of rod to be attached.

Stops are used to support the switch rail against the web of the stock rail. They are generally made of 2 in. by ⅜ in. material. It is customary to put 2 stops in a 15-ft. switch, 1 to each point; 4 stops in 18-ft. and 20-ft. switches, and 6 stops in 30-ft. and 33-ft. switches. Switches under 15 ft. usually do not require any.

RODS

Rods or tie bars are used to couple the switch points together, the number of rods required depending on conditions. The tendency is to get along with as few rods as possible, stiffening the switch by reinforcing bars instead. The practice is to use 2 rods for switches up to and including 15-ft. and 16-ft. 6-in. lengths; 3 rods for 20-ft. and 22-ft. switches, and 4 rods for 30-ft. and 33-ft. switches. For rigid-connected switches most companies use a bar 2½ in. wide and ¾ in. thick. The first or head rod of the switch must be long enough to extend beyond the stock rail so that attachment can be made to a throwing mechanism by means of a connecting rod, and also to act as a "hold-down" for switch rails. Some designs provide for attaching the connecting rod to the middle of the head rod. The rods are usually connected to the sockets or clips by vertical pins or bolts to allow a slight rotary motion when the switch is thrown. The length of the rods between pins is usually fixed.

On account of lost motion developing through wear or variations in the gage of the track and the throw of switch mechanisms, it is often considered desirable to give adjustment by which the length of the rods or the distance between pins can be varied. There are numerous



FIGS. 10, 12, 13 AND 14—INSULATION, BRACE AND SLIDE PLATES

devices in use for that purpose. Perhaps the simplest and most economical one is a turnbuckle with lock-nuts, which at the same time is the most sensitive for adjustment.

In place of the adjustment, a spring may be interposed at the point of attachment of the connecting rod (Fig. 9). In this case the wear and lost motion are taken up automatically by the spring. The holding of the switch point securely against the stock rail or main rail depends upon the stiffness of the spring. On the other hand, a train can trail through a spring-connected switch that is set wrong without injuring the switch.

In order to keep electric current for signals, etc., from being conducted through connecting rods from one rail to another, insulation must be introduced between the rods and the attachment. One method is to cut the rods in two and connect them by separate bars with insulating material interposed, as shown in Fig. 10.

A rod which has more recently come on the market,

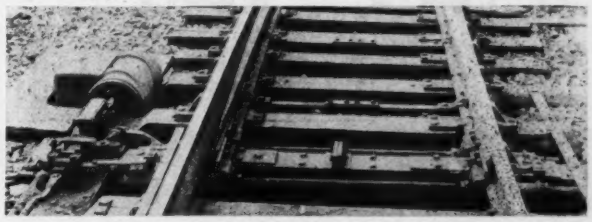


FIG. 11—A RECENT DESIGN OF SWITCH ROD

combines the adjustable features and insulation in a simple manner. It is made of one heavy continuous bar of round steel, threaded at both ends and on which are mounted insulated sleeves, which, together with the switch point clips and hanger-washers, are held rigidly in their proper position by locked nuts. Connections can be made directly with any interlocking machine. It is shown in Fig. 11.

BRACES AND SLIDE PLATES

Switch braces, to be efficient, must be designed not only to resist the side thrust on the stock rail, but also to hold the rail down by being fitted tightly over the flange of the stock rail. The most efficient brace would be one which would in addition support the side of the head, shown in Fig. 12, but this feature frequently has to be eliminated to provide clearance for detector bars or similar devices.

There are many styles of braces in use, made of cast iron, pressed steel and malleable iron. The last named seems to be gaining in favor as more effectively resisting corrosion. The ones most used are 5 in. and 6 in. wide and ⅜ in. thick. Pressed steel braces can be made any width, although the general practice is to make them 4 and 5 in. wide, with ¼ in., 5-16 in. and ⅜ in. in thickness of metal.

In recent years several types of adjustable braces have been put on the market. Most of these insure the brace being tight against the rail and hold it firmly in position. The Pennsylvania Railroad has adopted an adjustable brace as standard on all its switches.

There is no rule for the number of braces required on a switch. Almost every road calls for a different number. Taking an average from the standard plans of 15 important roads gives the following:

10-ft. switches	10 braces
15-ft. switches	14 braces
18-ft. and 20-ft. switches	20 braces
24-ft. switches	24 braces
30-ft. switches	30 braces

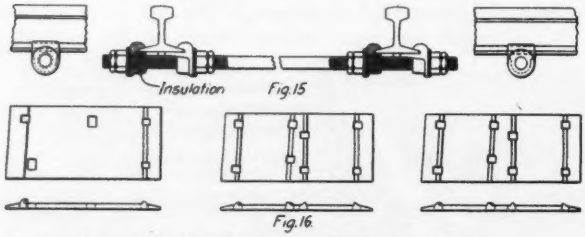
The above number seems to cover all conditions, and there is no reason why they could not be adopted as a standard.

The American Railway Engineering Association standards for switches call for the following:

11-ft. switches	12 braces
16-ft. 6-in. switches	18 braces
22-ft. switches	26 braces
33-ft. switches	40 braces

Slide plates in switches are used to elevate and support the switch rail. They should be of good width and abso-

lutely flat on the bottom to give ample bearing upon the tie. One important feature that all slide plates should have is that the set of the plate should be absolutely square and not rounded, so as to give a good shoulder for the inside edge of the base of the stock rail to prevent it from working out from under the brace. To secure the brace from backing away from the stock rail the end of



FIGS. 15 AND 16—GAGE ROD AND PLATES

the plate is sometimes toed-up, or forged up. Fig. 13 shows some of the more popular plates in use. (A) shows a hammered plate in which half of the plate is forged or drawn out to the required set. These plates are made from 4 in. to 8 in. in width. (B) shows a pressed plate in which the riser is pressed up. This plate is usually made in 4½-in., 5-in. and 6-in. widths. The full tie bearing is sacrificed in this plate. In both of the above styles the ends can be forged up as shown in (H). (C) shows a solid plate in which the set is planed out. It is generally made in widths from 6 in. to 8 in. (D) shows a similar plate with two sets planed out—one for the stock rail and the other for the rail brace. (E) shows a Ramapo plate. It is rolled in 5-in., 6-in. and 7-in. widths. (F) shows a plate rolled by the Illinois Steel Company. (G) shows a plate with the riser riveted on. This is now but seldom used, as the rivets are liable to become loose.

Of the plates described, the solid planed plates (C) and (D), and the Ramapo plate (E) are perhaps the most popular. The plates with the 2 sets planed out are considered the best.

Here, as in the case of the braces, there is no rule to follow as to the number required in a switch. Taking an

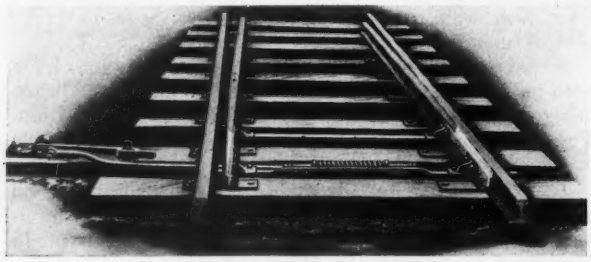


FIG. 17—SHORT MANGANESE TIP

average from the standard plans of 15 important roads, we have:

10-ft. switches	14 plates
15-ft. switches	20 plates
18-ft. and 20-ft switches	26 plates
24-ft. switches	30 plates
30-ft. switches	40 plates

The above number appears to cover all conditions.

The American Railway Engineering Association shows the following on its standard switch:

11-ft. switches	20 plates
16-ft. 6-in. switches	26 plates
22-ft. switches	38 plates
33-ft. switches	60 plates

The differences in the above figures result from the fact that the American Railway Engineering Association, as already mentioned, recommends that the switch point be ¼ in. higher than the stock rail throughout its length, necessitating riser plates the entire length of the switch plus the plates beyond the joint of the switch to allow for the gradual slope of ¼ in. in the height of the lead rails. In light traffic, slide plates placed one tie beyond the end of the planing of the switch point are considered sufficient.

Where interlocking systems are located, particularly in terminals, the greatest attention must be paid to the correctness of gage at the switch points, as in some cases not even 1-16-in. play can be allowed. To prevent variations gage plates are put in at the point of the switch. Fig. 14 shows a typical gage-plate. Some designs call for as many as 3 gage-plates, one in front of the switch, one at the point, and the other about the second tie from the point. Some gage-plates are provided with outside braces. Gage-plates are insulated, where required, in a similar manner as described under switch rods. Gage

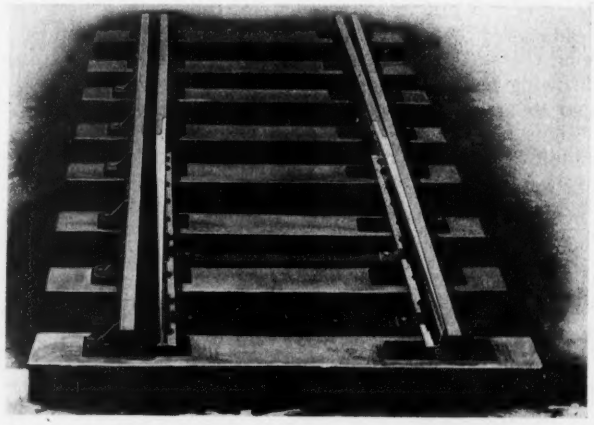


FIG. 18—A LONG MANGANESE SWITCH POINT

rods as shown in Fig. 15 are also used in place of, or in conjunction with gage-plates.

In main line traffic some of the larger companies call for either cast iron or cast steel heel blocks, usually cast steel. They are made the length of the joint plates. The object of these heel blocks is to hold the spread of the switch at the heel, where the pounding and side thrust of the wheels are the greatest. Another method of holding the spread at the heel of the switch is the use of anti-spreading tie-plates (Fig. 16). They not only hold the spread, but also help to keep the rails level. They should be made of good width.

Switch guard rails are placed in front of switch points to prevent wheels especially of slewed trucks from crowding over and striking hard against the extreme point of the switch. They are principally used on curves and are made of variable lengths from 6 ft. to 15 ft.

MANGANESE STEEL SWITCHES

On main line traffic where there is extreme wear on the switch, manganese steel tips are put on the point. They are castings about 30 in. long, although on curves or where there is heavy side wear, a longer casting is used, usually as long as the length of the planing. In these cases it is only necessary to put the long manganese point on one side of the switch.

In a manganese steel tip switch the head of the rail is cut away for the length desired, and the manganese steel tip set thereon and attached to and supported by the web and base of the switch rail. On one side the tip has a

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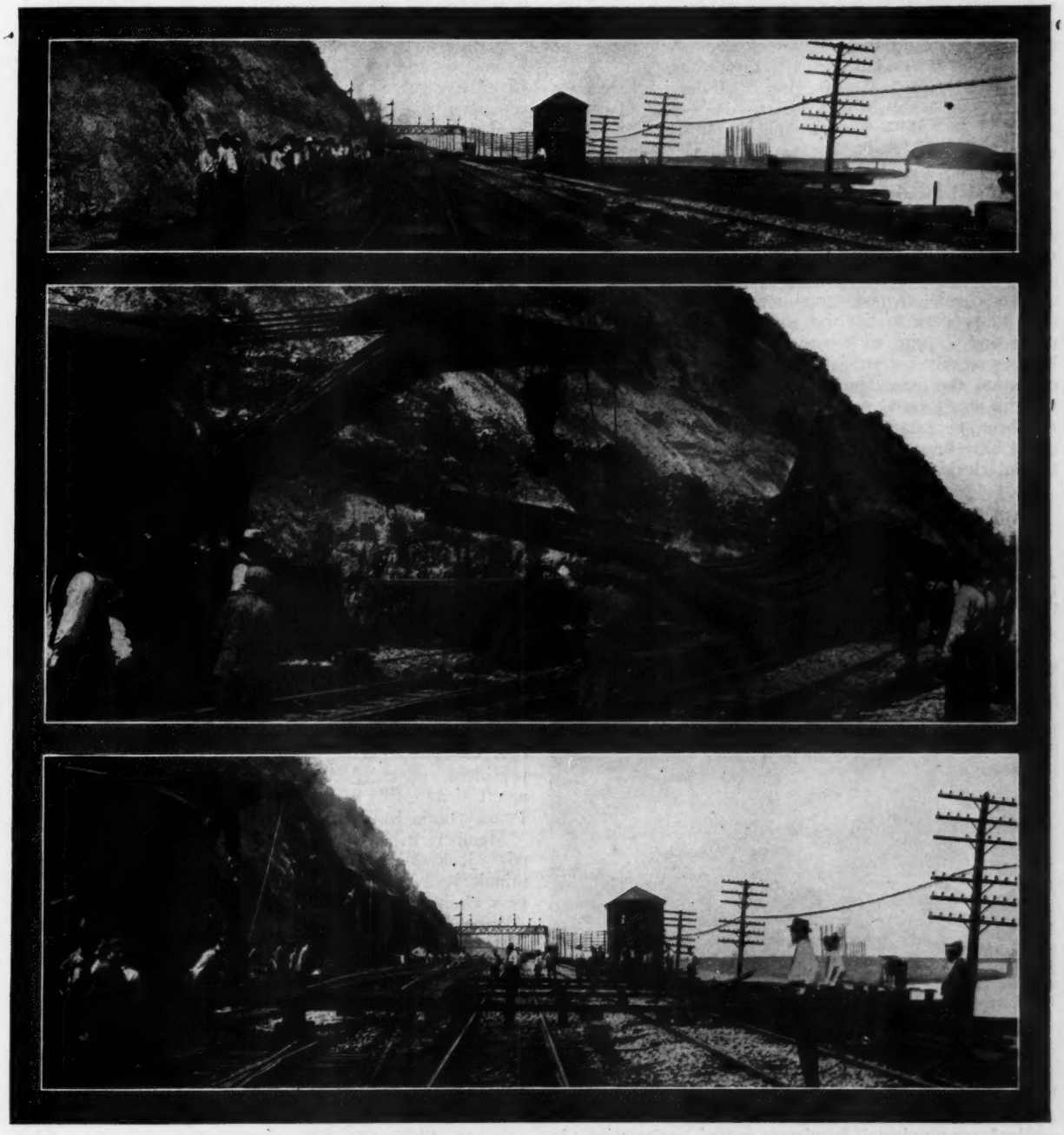
tail piece about 10 in. long which runs into the fishing section of the rail. On the other side a reinforcing bar runs along the whole length of the manganese tip and beyond to at least the end of the planing. Fig. 17 shows a short point recommended by the Manganese Track Society, while Fig. 18 gives an illustration of a long point. The high cost of split switches made of rolled manganese steel rail has prevented any extensive use on steam railroads, where the manganese tip switch seems to fill all requirements.

The Quick Renewal of Slip Switches

THREE double slip switches were recently renewed in the busy main line of the Pennsylvania Lines, Southwest System, about three miles west of Pittsburgh in an interesting manner and in an unusually short time. These slip switches were built of 100 lb., P. S. rail, were 114 ft. long and weighed about 32 tons each. They were located at an interlocking plant through which there are about 350 train movements every 24 hours. It



THE SLIP SWITCH ASSEMBLED AT THE RIGHT
LOADING THE OLD SLIP ONTO CARS
THE NEW LAYOUT READY TO LOWER INTO PLACE

was, therefore, necessary to adopt a method which would require the minimum interference with traffic.

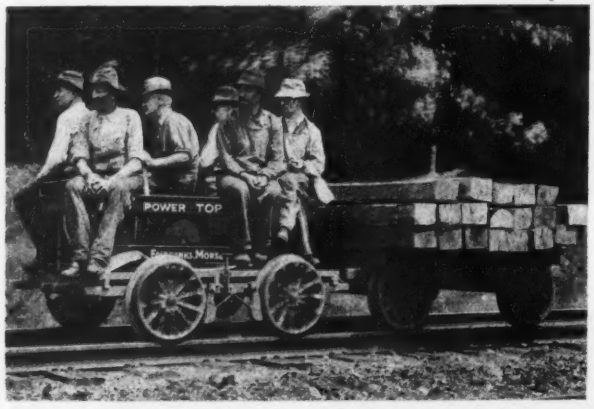
The switches were assembled complete at one side of the track and were then slid across the intervening tracks and dropped into place. Because of the presence of a high hill on one side and a retaining wall on the other it was necessary to assemble them, including the ties, in the only available room on blocking over the interlocking pipe lines approximately opposite their proper position in the track. New material was used throughout and all work even to the interlocking connections was completed.

Previous to the renewal of the switches the old ballast, which had become clogged with dirt washed down from the hillside, was dug out and 10 in. of new stone ballast was placed. This consumed about one hour's time. Because of the density of the traffic only one slip was renewed in a day, the work being done when there was the greatest interval between trains.

To avoid any chance of a delay two derrick cars were employed to handle the switches, one being placed at each end of the slip to be renewed. Before proceeding with the work permission was secured from the despatcher to block the tracks at the interlocking. The old slip and the ties were loaded by the derricks on two flat cars standing on an adjoining track, which operation required 10 min. Four rails were then laid across the main tracks on which the new slip was pulled into place. It required 5 min. to prepare for this movement, another 5 min. to pull the slip over its final location, 5 min. to prepare to lift the slip, 3 min. to drop it into place and 7 min. to connect up the track and interlocking readily for service, or a total of 25 min. In this operation the main tracks other than the one in which the slip was located were blocked only 8 min. If it had not been necessary to renew the ballast the old slips could have been taken out and the new ones put in with the interlocking disconnected only 30 min.

A POWER PLANT FOR HAND CARS

A COMPLETE self-contained power plant for hand cars has recently been placed on the market which is designed to meet the demand for a gas-engine outfit by means of which a hand car may be converted into a motor car at relatively small expense, thereby permitting



THE POWER TOP IN SERVICE

a railway to realize a large part of its investment in a hand car while providing its workmen with a power-operated car. This feature is of particular importance in view of the large number of hand cars owned by the railroads, which they hesitate to discard until worn out.

The power plant complete is enclosed in a frame, the top of which provides seats for a crew of eight men. The frame can be installed on a car with few alterations to the old equipment. The idea of simplicity has also been carried out in the engine, it having been the aim in the design to secure a minimum number of working parts. A 5-hp. air-cooled motor is provided which is of the same type as the one used on the Sheffield steel frame motor cars. Being intended for the exclusive use of kerosene, it has been designed especially for the use of that fuel and is said to operate successfully at any temperature encountered in railroad service. Balance is obtained by the use of duplicate fly wheels on opposite sides of the crank and starting and stopping of the car is manipulated with the belt drive by adjusting the tension on the belt. This is secured by sliding the engine bodily on the sub-base plate through the agency of a lever.

The outfit, ready to attach to a car, is 25½ in. wide, 74 in. long and weighs 415 lb. It is rated for a speed of 15 miles per hour in either direction. As shown in the accompanying photograph, a car thus equipped can be used to haul loaded push cars, a feature of growing importance in maintenance of way work. This equipment is known as the "Sheffield Power Top" and is manufactured by Fairbanks, Morse & Company, Chicago, Ill.

A. R. E. A. NOMINATIONS

THE nominating committee of the American Railway Engineering Association has submitted the following nominations for officers of the association for the coming year. Ballots will be issued to members about February 15, 1917:

President—John G. Sullivan, chief engineer, Western Lines, Canadian Pacific, Winnipeg, Canada.

Vice-President—Earl Stimson, engineer maintenance of way, Baltimore & Ohio, Baltimore, Md.

Treasurer—Geo. H. Bremner, district engineer, Interstate Commerce Commission, Division of Valuation, Chicago, Ill.

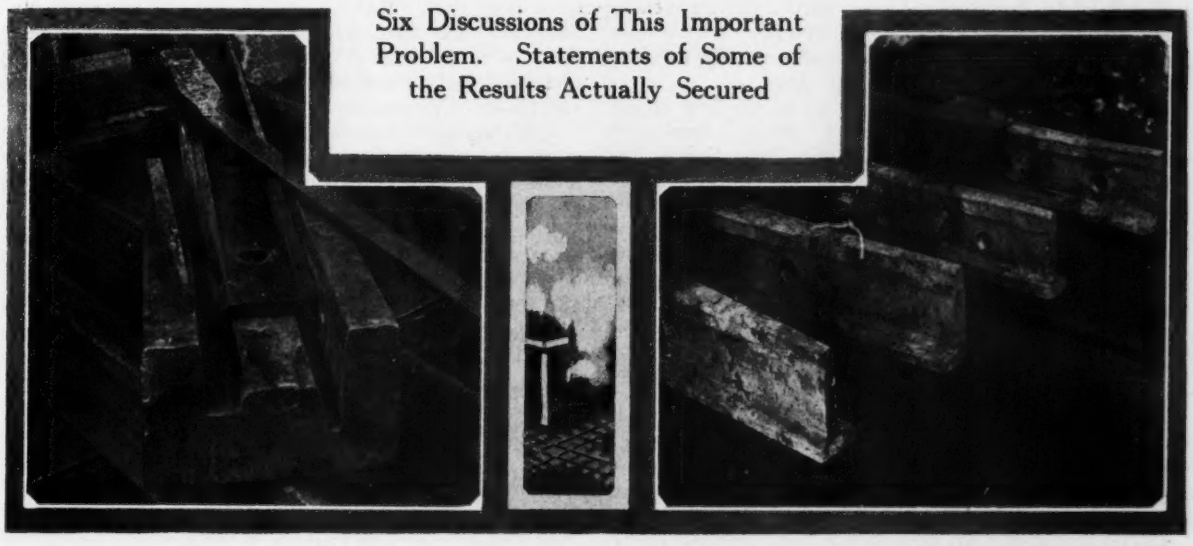
Secretary—E. H. Fritch, Chicago, Ill.

Directors (three to be elected): J. A. Atwood, chief engineer, Pittsburgh & Lake Erie, Pittsburgh, Pa.; Hadley Baldwin, assistant chief engineer, Cleveland, Cincinnati, Chicago & St. Louis, Cincinnati, Ohio; W. H. Courtenay, chief engineer, Louisville & Nashville, Louisville, Ky.; L. A. Downs, general superintendent, Illinois Central, New Orleans, La.; S. B. Fisher, engineering department, Missouri, Kansas & Texas, Parsons, Kan.; H. E. Hale, group engineer, Presidents' Conference Committee, New York City; John D. Isaacs, consulting engineer, Southern Pacific, New York City; E. H. Lee, vice-president and chief engineer, Chicago & Western Indiana, Chicago, Ill.; E. B. Temple, assistant chief engineer, Pennsylvania Railroad, Philadelphia, Pa.

Members of Nominating Committee (five to be elected)—J. R. W. Ambrose, chief engineer, Toronto Terminals Railway, Toronto, Ont., Canada; Geo. H. Burgess, chairman valuation committee, Delaware & Hudson, Albany, N. Y.; W. M. Dawley, assistant engineer, Erie, New York City; V. K. Hendricks, assistant chief engineer, St. Louis & San Francisco, St. Louis, Mo.; W. T. Dorrance, chief draftsman, New York, New Haven & Hartford, New Haven, Conn.; B. H. Mann, signal engineer, Missouri Pacific, St. Louis, Mo.; J. A. Peabody, signal engineer, Chicago & Northwestern, Chicago, Ill.; S. T. Wagner, chief engineer, Philadelphia & Reading, Philadelphia, Pa.; C. A. Wilson, consulting engineer, Cincinnati, Ohio; H. S. Wilson, engineer maintenance of way, Pittsburgh, Shawmut & Northern, Angelica, N. Y.

RECLAIMING SCRAP MAINTENANCE MATERIALS

Six Discussions of This Important Problem. Statements of Some of the Results Actually Secured



Five Steps in the Repair of a Frog Point.

THE prize-winning paper in the contest on the Reclamation of Maintenance of Way Scrap Materials was published in the *Railway Maintenance Engineer* for October. The paper winning second prize and two others appeared in the November issue. Other papers on this important subject, received at the same time, appear below:

RECLAMATION AT A CENTRAL PLANT

By F. B. Grant

Foreman of Scrap Dock, Chicago Great Western, Oelwein, Ia.

The reclamation of material begins at the time it is picked up on the line and does not cease until the reworked article is again placed in service. No one scheme or plan will fit all conditions. A practice which fills the bill for a road of 200 miles might not be a paying proposition for one extending from coast to coast. As a rule, scrap should be picked up along the line and assembled at some convenient point (section shanty or the like) since it thus becomes more available for quick movement than when scattered. Moreover, a pile of scrap concentrated at one point attracts more attention and invites prompter handling than if it were strewn over a large territory. From these designated places it can be loaded at intervals suitable to conditions, and sent to a central scrap yard for sorting and reclamation. In loading, all rails, switch points and frogs should be separated from small track scrap and placed on cars, conforming to conditions of the central plant, flat or open cars being preferable where derricks or cranes are used.

Reclaiming material at its point of origin may suffice on some roads, saving the back haul, but in the majority of cases better results are obtained from a centralized plant. Economy should be the watchword of all reclamation, and the organization necessary to give best results can only be justified in a plant large enough to reclaim material in such quantities that the saving will pay for it. Labor can be more efficiently educated and worked to better advantage. Many times road scrap is picked up along the right of way by a work train and a large crew of men, and any delay caused by sorting out usable material would quickly mount into dollars. Again a centralized plant justifies the expense of machinery and tools for quick, cheap handling that would be prohibitive in small plants. If reclamation is to pay, handwork must be eliminated wherever possible by the use of labor-saving cranes, magnets and machinery. The distribution of reclaimed material can also be accomplished more advantageously from a central plant. Surpluses which accumulate in small quantities at a number of small plants are avoided and the material can be distributed where most needed.

The reclaiming sheds on the Chicago Great Western are not expensive. They are constructed of old car sills and car doors with ordinary unskilled labor such as the scrap dock pay roll affords, and are sufficient to fill the bill in every respect. In these is installed the machinery necessary for reclamation work; alligator shears, Beaudry hammer, 6-spindle nut tappers, bolt threader and coupler and brake beam stripper, with an acetylene plant, a crossing repair shop and a high speed rail saw mill. Not all of this machinery is necessary for the reclamation of maintenance of way scrap; such material is but one item in the varied assortment received.

In sorting rail, the first consideration is to pile separately that which can be utilized again for some purpose. Serviceable rails which are sound in the ball and flange and need no labor to put them back into service are piled upon skids, as relayers. Sometimes a rail is in good condition with the exception of battered or broken ends. By cutting 10 or 12 in. from each end and redrilling, it can be used for side or passing tracks. Other rails may be bent or broken in such a way as to cull them from the above classes, although they have parts which are serviceable. These are used for making guard rails or for crossing and frog repairs. Any piece 8 ft. long or over is utilized for these purposes. The balance is scrap and is either loaded directly into cars for immediate shipment or is piled upon the platform for magnet loading later.

Frogs and switch points undergo a similar process. Repairable frogs are assembled and the worn or broken parts renewed, while those which are beyond reclamation are stripped and the fillers, washer plates, etc., are used in building up other frogs. Scrap switch points are

stripped of their lugs and reinforcements, these parts being used again and the scrap parts, by so stripping, fall in a higher class. With the installation of oxy-acetylene it is expected to build up the worn parts and thus reclaim frogs and switch points more economically. Oftentimes guard rails are slightly bent and can be readily put into service by heating and bending into shape.

In unloading and sorting track scrap, the first object is to reclaim all usable spikes, switch stands, tie bars, connecting rods, angle bars, tools and the like. Spikes, for instance, are hauled directly after sorting to the Beaudry power hammer where they are straightened and fitted for service. Unskilled laborers operate the machine, so the cost of reclaim is slight. For the two years ending June 30, 1916, approximately 1,249 kegs of usable spikes of standard size were reclaimed.

New value, 1,249 kegs		$4,933.55
Scrap value	$1,249.00	
Cost of reclaimation	249.80	1,498.80
Saving		$3,444.75

Switch stands are not thrown into the scrap heaps unless of obsolete patterns, but are sent to shops and the broken parts released. The good parts of one stand are often substituted for the broken parts of another. By applying a straight edge to angle bars and patented joints, many of the best bars which are not dipped too much in the center are sorted out for side track purposes. An experiment is being made in planing down 85-lb. dipped bars to fit 75-lb. rail.

Track tools of all kinds are saved and repaired. Claw bars, which have served their full capacity as such, are converted into tamping bars. Shovel and scoop blades are fitted with new handles at a slight cost, good handles are stripped from broken blades and used again. Track chisels and spike mauls are drawn out and track jacks and drills repaired.

Serviceable or slightly bent tie plates have a way of getting into these scrap cars as do rail braces, switch lugs, connecting rods, slide plates and filler blocks, and little or no labor is required to put them back into service. It is a disputed problem as to what extent a road is justified in reclaiming materials which would otherwise be thrown into the scrap. The governing factor, of course, is the cost of reclaiming. Local conditions will often turn what is profit on one road into loss on another; worn-out ties, for instance, may be profitably used for firewood on western roads where timber is scarce, but might be an entire loss to roads operating in regions of plentiful fuel.

A big step in the solution of the reclamation problem is to keep the usable material out of the scrap. The old saw about an ounce of prevention is applicable here. Educate the users of material as well as the reclamation man. Teach them the value of what they are using in terms of dollars and cents.

The reclamation of scrap has great possibilities. Good work has been done toward effecting a saving along this line, but much is still to be done. With the education of the men regarding the money values of the materials used and the installation of proper equipment—rolling mills, rail saws, oxy-acetylene—to carry on the work of reclamation, the railroads will go far toward more economic operation, and the million-dollar-a-day waste of which they are accused will yet prove an idle dream.

RULES FOR RECLAMATION

By W. M. Jeffers

General Manager, Union Pacific, Omaha, Neb.

The abnormal market prices now prevailing and the difficulties and delays incident to securing new material at the present time emphasize the necessity of utilizing scrap of all kinds to the greatest possible extent, and the Union Pacific has given this matter special attention for some time past. Many items of released material, supplies and tools that have heretofore found their way to scrap piles and been disposed of as scrap are now being reclaimed and reused, this action being taken from the standpoint of protection as well as of economy.

Reclamation should begin with the foreman and the gang who release the material and at the time the material is released. A little care and attention then will accomplish a great deal. Released track spikes that are a trifle bent can be straightened out at once by a track laborer, providing there are no special facilities at scrap docks or reclamation plants for this work. Track bolts and nuts should, as far as practicable, be released with such care as to permit their reuse. In releasing rails, nuts should not be knocked or cut off the bolts merely because it is easier than to take them off with track wrench.

Released, serviceable track bolts and nuts should be properly segregated from the scrap at the time of release, in a box, keg or can provided for that purpose, and where one or the other is unserviceable, the serviceable bolts and nuts should be rematched. Such reclaimed bolts and nuts should, in turn, be oiled to prevent serious rusting, kept under cover and reused at the first opportunity in lieu of new material. In the same manner, angle bars, tie plates, switch materials, etc., that are serviceable should be segregated and reclaimed at the time they are released.

All released rail should be carefully inspected and marked at the time of release, to determine whether serviceable or scrap. It can also be marked to designate whether it is to be reused in main line, branch line or side tracks. Rail that can be made serviceable by resawing should be so designated and sent directly to the rail saw.

Surplus stocks of rails released along the line should be picked up and sent in to the division material yards. In fact, all surplus local accumulations of reclaimed track, bridge and building and signal material should be shipped in to the material yards for stock and in turn used, as far as practicable, to fill the line requisitions instead of issuing new like material.

Defective, yet repairable, track tools of every description should be sent in to a division track tool repair shop for repair and reissuance to the sections in lieu of new. It is important that the man who makes these repairs be an experienced tool repair man who understands not only how to repair the tools according to specifications, but is skilled at tempering the metal to give the best service.

Released frogs and switches should be segregated between scrap and repairable—those that are repairable to be sent to the division frog and switch repair shop. The frogs and switches that must be scrapped will, by taking them apart, frequently furnish many useful parts for repair work at the shops.

Released, unserviceable bridge and building timbers, bridge ties, piling, poles, etc., providing they contain 7 ft. or more of sound timber should be converted into fence posts. Economies, through reclamation, can be carried out in the bridge and building and signal departments along the same general lines as in the track department. All scrap should be picked up and shipped in to the store department scrap docks or reclamation plants, where it should be carefully sorted, classified and, above all, gleaned to recover all possible usable and repairable material—also certain sizes and kinds of wrought scrap and forgings which can be utilized or reworked by the shops into shop-made standard material for the demands of the road.

REQUIREMENTS OF SCRAP SALVAGE

By D. C. CURTIS
Inspector, Stores Department, C. B. & Q., Chicago, Ill.

Reclamation has come to mean to many the reclaiming of material from scrap only, but this word has a broader meaning—getting all the service value from the material at the lowest possible cost to the railroad. It is essential to avoid any unnecessary expense in reclaiming material. This is one of the hardest problems to solve, for it is very easy to spend more money in repairing material than it is worth when reclaimed. A large part of it should be so handled that it will be unnecessary to reclaim it from scrap. A frog or switch point taken out of the main line and fit for further service should be used in the adjacent yard while track spikes removed can be straightened by the lamp man during his leisure time and used in the yard. This eliminates the cost of loading, hauling to the scrap dock, unloading, sorting, repairing, loading and hauling back again. It requires careful and constant study of all conditions by the superintendent and the roadmaster and the education of the section foremen to see that all the use possible is obtained from material before it is sent to the scrap dock. The storekeeper should watch the issues of all material and call attention to all cases where the old material should have been repaired and used. Old material should be returned for new wherever possible.

The users of material should be educated as to its value in dollars and cents. Practical lessons by the officers are the best means of doing this. A price book should be carried in the pocket and when opportunity shows that material could have been saved the officer can well afford to sit down with the man at fault and show him the loss to the company in dollars and cents.

Reclamation should be under the general supervision of the store department, if for no other reason than to avoid a duplicate pay roll. It is the department responsible for all material not in use, and with which all orders for material are placed. Consequently, it will get the material into service quicker and, by having a check on the reclaimed material, it saves buying new. The scrap dock is under the store department. The reclamation plant should be adjacent to the scrap dock and part of it. The organization of the plant, as well as the equipment, will depend upon the size of the road and the amount of material available. A good foreman should be placed in charge who is thoroughly familiar with the use and value of the material to be reclaimed. His work should be checked by superior officers to see that the best results are being obtained. Adequate wage rates should be established so that efficient, permanent and satisfied help will be maintained. It takes time for men to become efficient in this class of work. The billing of all cars received at the scrap dock should show from where and by whom they were sent so that any case of improper handling of material may be corrected.

The reclamation plant should be equipped the same as any well-managed shop. Where second-hand machinery will serve the purpose it should be used. Where new machinery will pay for itself in a short time, it should be purchased. There is a tendency to use old, discarded machinery at a reclamation plant, but in most cases the saving in cost will be canceled in a short time by an increase in the labor charge.

The equipment of a plant should include a spike straightener, forge, anvil, vise, sledges, hammers, etc., shears, bulldozer, air hammer, resaw outfit complete, rail saw and drill press, oxy-acetylene or electric welding plant and a tie plug machine.

A very good spike straightener can be made from an old air cylinder, an engine deck plate and a little pipe. A resaw outfit for resawing old bridge and building lumber, having a cut-off saw and table resaw, will reclaim old second-hand lumber and even cribbing can be worked up to advantage. A rail saw outfit with drill press, etc., should be provided to saw relaying rail, guard rails, angle bars, etc.

The oxy-acetylene or electric welding outfit is a big money saver when there is enough work to justify its use. The tie plug machine should be located in the planing mill to use the mill waste without extra handling. The kind and amount of machinery will depend on the size of the plant and the work to be performed. It is better to go slow in installing machinery to meet the needs as they arise, but a comprehensive plan should be laid out at the beginning so that the units can be properly placed as they are needed.

The rail saw, together with the rail yard, create the largest item of saving. Angle bars can be cut off and repunched. Tie plates can be repunched, old style switch stands can be used for industry tracks, derails and unimportant sidings. Old frogs can be repaired and used in yards, as well as switch stands, rods, braces, guard rails, etc.

Material with the exception of rail and ties should be reclaimed by letting the operating account stand the cost of reclaiming and then taking the material into stock and issuing it at its new value. The value of the material regulates its use to a large extent and when an article is charged to a man at a certain price he tries to get that value out of it; if it is cheap it is put in cheap service, and if valuable, in valuable service.

SOME EXAMPLES OF SCRAP SALVAGE

By H. E. ROUSE
General Storekeeper, C. G. W., Oelwein, Ia.

The cost of recovering the usable material from the scrap at the central yard, when conducted in connection with its classification for sale, involves but little additional expense, because with an efficient organization to classify for sale, the separation of the good from the scrap requires no appreciable extra effort. The classifying of the scrap into several commodities instead of disposing of it in a mixed condition is a money-making operation because of the higher market price for the classified scrap as compared to the price offered by dealers for it mixed. As an example of what can be done, some of the maintenance of way commodities are enumerated below which can be reclaimed with profit as determined from actual demonstrations.

Tons of track spikes are gathered up from the right of way where rails have been changed, new ties have been put in or because of other repairs necessitating their removal. Many of the spikes are of full size and strength, but few are removed without bending or distorting them to some extent. It has been demonstrated that one man with a small power hammer can straighten and store away an average of one keg of 200 lb. per hour or one ton per 10-hour day. Allowing an equal amount, which is liberal, for separating and delivering the defective spikes to the power hammer, the total cost is $4 per ton for recovering, straightening and storing them ready for reissue for use. Add this to the value of No. 2 wrought scrap and subtract this total from the price of new spikes and there is obtained the net economy effected by the reclamation process, which will approximate at present market conditions about $20 or more for the day's work.

In the process of rail or rail joint renewals the joints removed are in varying conditions ranging from cracked

or broken joints, which class as scrap, to those which are but slightly worn and in condition to be placed back into other service just as they are. Therefore, the first step in reclamation is to select such as will stand a "straight edge" test. But between this class and those that are obviously scrap there is a large class which has been too commonly going into the discard. It frequently occurs that the spacing of the bolt holes is the same in rails of sections not differing greatly in weight. When such conditions exist, as, for example, in 75-lb. and 85-lb. rail, it is found that by clamping the 85-lb. angle bars on to a planer in gangs and working to a jig that the tops of those that have been worn can be planed off and made first-class joints for 75-lb. rail without destroying the alignment of the bolt holes. About 1¼ tons can be given this treatment in a 10-hour day.

Anyone who will make a careful study of the scrap rail coming into the scrap yard will be impressed with the possibilities along reclamation lines. By observing the condition of many of these so-called scrap rails it will be found that a large percentage of them are scrap because of some defect that has developed at the end or at some point in the rail which, if cut away, would leave a perfectly good relayer rail of shorter length for side yard, branch or secondary line track. In the case of No. 2 quality relayer rails, by cropping the flattened and worn ends and redrilling they are made even better than the rails which would be classed as No. 1 relayers as they come from the track. By following the same line of reasoning and by giving the No. 1 relayers this same attention they will be in a condition to go back into main line service for a period of time almost equal to the service they have already performed. To do this kind of work economically would mean the installation of a rail-rehabilitating plant comprising a high speed friction saw, rail drills, roller conveyors for machinery, storage skids, track facilities, etc., which would represent a considerable investment and the volume of this class of work to be done would be the governing factor in justifying an investment. The cost of doing the work should not exceed $1.50 a ton, a rate that would justify the work on more rail than is required for side and yard track requirements as it would be readily salable at a greatly increased value.

It has been necessary for many railroads to replace light capacity bridges with heavier structures, thus creating an accumulation of enormous tonnage of so-called "uncut bridge scrap." This class of scrap does not usually command a very high quotation in the scrap market, because it is difficult to handle and reduce to a reworkable size. Therefore, by cutting it apart it may be used in place of new material for railway uses as well as increasing the value of the portion which is finally sold.

Recently it was necessary to supply a quantity of steel plates with which to repair a mechanical coaling station. The cost of new plates at the prevailing market would have been $760. Suitable plates were recovered from the bridge scrap which if sold would have brought $143. The labor cost of stripping was approximately $15, the extra labor necessary to use this recovered material, for cutting to size, etc., approximated $25, or a total of $183, thus giving a saving of $577.

It has been a prevailing custom to use old bridge timbers "any old place" without attaching much value to them, as there were decayed spots here and there and the timber had a weather-beaten appearance. By the use of a power rip saw the sound portions of these timbers can be cut to usable dimensions and the cost of such work, including the removing of nails, drift bolts and other obstructions which might be found, should not exceed $2.50 per M ft. B. M. of recovered lumber, which would cost probably $25 per M laid down in the yard.

RECLAIMING SCRAP SWITCH MATERIAL

By I. B. Stutsman

Superintendent of Frog and Switch Shop, C. M. & St. P., Tomah, Wis.

Because the Chicago, Milwaukee & St. Paul manufactures practically all of its own switch material, greater possibilities are seen in the scrap pile than on most roads. The interest lies primarily in the recovery of the usable fabrications, or parts of frogs, crossings, etc., other than the rail portion. Occasionally a frog is received on which the point and wing rails are not too badly worn or battered, so that it can be rebolted, placed on a planer and straightened up at a cost of a few cents; or a frog with either the point or a wing rail broken, while the rest of the frog is practically new, can have the broken part replaced while making up new frogs of the same kind. In general, however, it has been found poor practice to attempt to repair a frog by replacing a worn or battered wing rail with a new one, putting it alongside of a frog point that is somewhat worn, or vice versa, as such frogs do not ride evenly.

Enough usable material is recovered from scrap receipts to permit credit to be given to the divisions for from 50 to 100 per cent more than the actual scrap value of the material sent in. The usable frog and crossing plates, rolled steel fillings, crossing knee braces, frog and switch reinforcing scraps, etc., are applied directly in the manufacture of new articles of the same kind, or articles which are the equivalent of new, the rail portion being entirely renewed.

As an illustration of the value of the fabrications that may be recovered from No. 10 15-ft. 90-lb. scrap spring rail frogs, if the filling, reinforcing bar, plates, spring pockets and springs, and heel and toe castings, weighing 600 lb., are all usable, the value of the new material they will replace is $11.20. To this is added $0.90, the labor cost for machining the corresponding new material. This does not mean that $12.10 worth of usable material as recovered from every scrap frog of this kind, but the point to be emphasized is that the rail portion of a frog is the part that receives the direct frictional wear from the rolling stock, while the wear on the filling and other parts of the frog is minor. Usually the filling and many of the other parts of a frog can be used over many times before they become too badly worn to be serviceable. The same is true of the reinforcing straps on a switch point and other switch accessories.

On the St. Paul, all switch material is standardized in construction, the parts of a frog, switch, switch stand or switch rod are all machined to jigs and templates, and they are interchangeable, so that usable parts of an article recovered from scrap can be applied directly to new ones of the same kind.

In the purchase of switch material, particularly frogs, many roads rely on general specifications, leaving all or most of the details to the discretion of the manufacturer, and buying where they can get the best delivery and price. The fabrications from frogs so purchased are not interchangeable, owing to differences in shop practices. Roads that follow this practice usually sell their scrap without dismantling.

Railroads might preferably confine their business to one manufacturer, and enter into a contract whereby all material would be manufactured to fixed standards, so that corresponding parts of like articles would be interchangeable. A road could then dismantle its own scrap switch material, sort and classify the usable parts, and

return them to the manufacturer to be incorporated into new articles; a reasonable credit being allowed by the manufacturer for them. Any road that receives less than $35 or $40 per ton for such of the scrap frog fillings as can be recovered under the above arrangement, is not working along economical lines.

Disregarding the usable material recovered, it pays to dismantle scrap frogs and crossings. Scrap dealers pay approximately $2 per ton difference in price for dismantled and non-dismantled scrap and frogs can be dismantled for about $0.50 per ton, thereby realizing 300 per cent profit on the labor expended in so doing. This work is done entirely by strong laborers with track chisels and sledges for splitting nuts, round, flat-pointed punches for knocking off rivets, and suitable drift punches for backing out bolts. It is surprising to note the number of frogs two men can cut apart in a few hours when they become reasonably proficient.

We use a locomotive crane to spot cars and unload scrap from gondolas. Scrap switch points, guard rails and dismantled frogs are piled across parallel skids. A special hook has been devised for use with the crane, which swings under the scrap pile and picks up three to five tons of rail at once, and when swung over a gondola car dumps automatically from the side. The rails drop into the car straight and require no hand labor to straighten them around. Devices of this kind save much hard manual labor and prevent injuries to men. While I have observed some advantages over our present practice in the use of a magnet for handling scrap switch material, there is the objection that it requires considerable hand labor to straighten scrap frog material so deposited.

RECLAIMING SCRAP ON THE ROAD

By J. E. Conroy
District Storekeeper, C. & N.-W., Missouri Valley, Ia.
Missouri Valley, Ia.

The handling and use of maintenance of way material and scrap from the standpoint of economy is a subject that deserves considerable investigation and study. This class of material is generally distributed over large territories, and is, therefore, most difficult to handle.

Thousands of tons of track and boat spikes, bolts, nutlocks and other small items of material are being thrown into the scrap piles every year by inexperienced men and go back to the general storehouse and yards. Many of these spikes are frequently brand new, or only slightly bent, others slightly throat cut. These spikes could be reclaimed by the men who pick them up along the track before they go into the scrap bin or scrap car. Much material of this kind is being reclaimed every month at the larger shops and scrap docks, but this costs money that could just as well be saved by the men who clean up the tracks where the work was performed, placing the usable materials in separate kegs or boxes from the scrap and so marking them that they would be placed in store and used again, without entailing any expense at the scrap yard for separation.

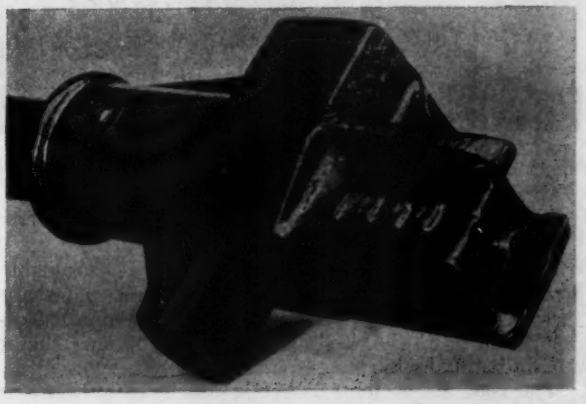
The scrap pile is ordinarily a place to throw everything that is left over after a job is completed. Whether new or old, it all goes to the scrap pile. We must get away from the scrap bins. For instance, after we replace ties, all the old ties that may be used for other purposes should be saved. All the spikes, bolts and fastenings should be straightened out and used for sidings and other tracks where traffic is not so heavy. The same can be done with rails, switches and fastenings. One or more cars may be used for the scrap and others for the usable material.

Track, bridge and building, engineering men and others, are also apt to carry an overstock of maintenance of way materials, hiding it away for some unexpected emergency, until such bolts and nuts become rusty and unfit for use. This is wasteful and false economy, for much of the material thus held will find its way to the scrap bins unused sooner or later.

All timbers and lumber should be shipped to the division headquarters and sorted. At such places there should be located a small saw mill for the purpose of recutting such timbers into smaller sizes. About 75 per cent of the timbers taken out of bridges and old buildings can be cut into lumber and used for repairs to stock yards, sidewalks, platforms, etc. Of course, the largest expenditure of all maintenance of way material used is for track ties. Ties should be removed when necessary from main line tracks and sorted in piles, saving any suitable for sidings or bunk car tracks. Ties unfit for service in tracks should be saved and used for locomotive firewood, or cut into tie plugs. Sawed oak switch ties when not fit for further service in track or bridges could be used for gravel car side stakes by shipping them to the saw mill.

A NEW TRACK GAGE

A NEW track gage has been introduced during the last year which offers a means for measuring the gage on tracks on curves in cases where it is the practice to increase the gage distance in excess of the standard 4 ft. 8½ in. This is an all-metal gage with a wrought pipe cross-arm and malleable iron ends. The adjustable feature is provided in the single-lug end of the gage by a pocket containing six strips of ⅛-in. steel, one or more of which may be dropped down to cover the gage face, thereby increasing the gage distance by increments of ⅛ in. to a total of ¾ in. These plates are secured in place by means of a pin entering the end of the casting



THE ADJUSTABLE END OF THE GAGE

and passing through holes in the plates. There are two holes in each plate, the pin passing through one of them when the plate is in position over the gage face and through the other when the plate has been pushed back out of sight. The holding pin is held in position by a helical spring which insures that the plates will not be lost and yet permits the change in the gage distance to be made quickly.

This gage is known as the Davis adjustable track gage and is handled by the Equipment Improvement Company, New York. It is now in use on the Southern Pacific and the Union Pacific.

TIMBER DECAY AND ITS GROWING IMPORTANCE*

Plant Life that Commonly Infects Wood and the Methods Best Adapted to Prevent its Propagation

BY C. J. HUMPHREY
Forest Products Laboratory, Madison, Wis.

DECAY is due almost entirely to the growth of wood-destroying fungi within the tissues of the wood. There are many hundreds of different species of these which disintegrate wood in the forest but the greater part of the economic losses in structural timber is referable to a comparatively small number. These fungi are plants just as much as are tree and herbs. They differ merely in their form, lack of green coloring matter and methods of nutrition. While green plants absorb their food supplies from the soil through their roots, fungi derive their nutriment from the substance of the wood.

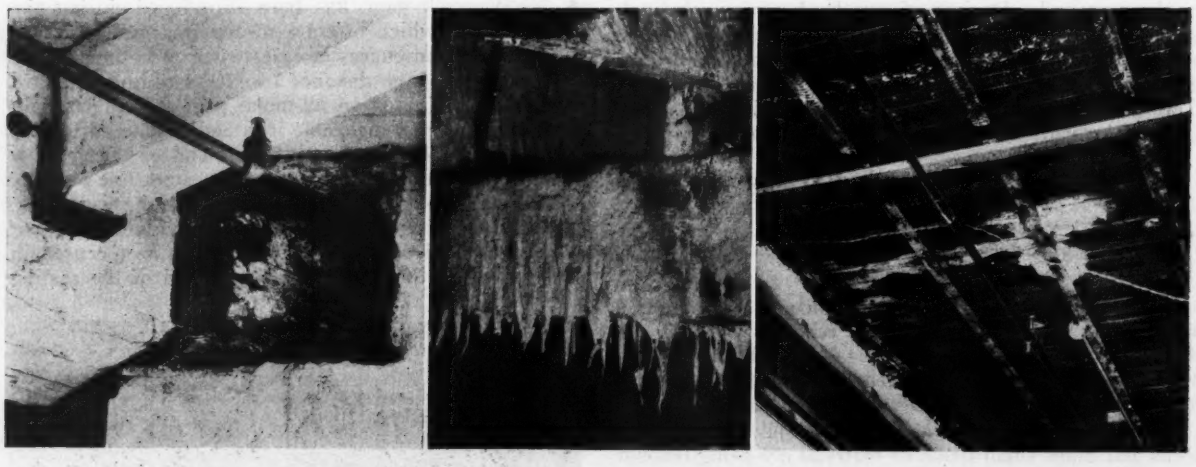
CONDITIONS ESSENTIAL FOR GROWTH.

In addition to available food supplies fungi require certain essential conditions for their development. These are sufficient moisture, at least a small amount of air within the wood and a suitable temperature. A suitable amount of moisture is, without doubt, the most important factor in decay. "Dry rot" organisms seem to get along on a comparatively small amount, while others thrive only in highly humid surroundings.

The need for at least a certain minimum of water is well shown under practical conditions. The points of failure in ordinary dry buildings are the points at which a little extra water is brought to, or held within, the timbers; for example, the ends of joists or girders set in brick or concrete walls, outer window casings, wood surrounding water pipes which may sweat or occasionally burst, porch floors and ceilings and other exposed trimmings, where atmospheric moisture may collect at the joints, and last and often most important, basement timbers, either in contact with, or close to moist soil.

Most people are familiar with the way in which posts and telephone poles rot at or near the ground line. Below the ground line the sapwood completely decays, while above the ground line a thin shell of dry hard outer wood remains, with the decay running up beneath it. This is entirely a result of moisture conditions. The same phenomenon often occurs in water tank staves where the outer face is too dry, and the inner face too wet, to decay, while an intermediate zone may completely disintegrate.

A certain amount of air within the wood is absolutely necessary for decay. The organisms need it for their growth. In saturated wood the air is, for the most part, displaced by water and fungus growth is impossible. The very widespread idea that decay is due to alternate wet and dry conditions has developed through observation of the way timbers behave when exposed to the elements. Take, for instance, a railway tie partly embedded in soil. During a dry season it may dry out to such an extent that decay is very slow, then come the rains, and if only sufficient water falls to put the tie in a good moist condition it begins to rot rapidly again, and will continue to do so as long as the moisture and temperature are favorable. If, on the other hand, there is a long-continued rainy period the tie may soon become saturated and decay will stop again and remain practically at a standstill until the stick dries out sufficiently to admit the necessary amount of air.



END OF DOUGLAS FIR GIRDER EMBEDDED IN CONCRETE COMPLETELY ROTTED IN 4½ YEARS (LEFT). MYCELIUM GROWING ON GIRDERS IN A BASEMENT (CENTER). SEVERE ROT IN LAMINATED FLOOR LAID GREEN AND COVERED WITH PLASTER (RIGHT)

The third essential condition for rapid fungus growth is a suitable temperature. For the majority of species the most favorable temperature lies between 75 and 85 deg. F. There are some exceptions to this, however, in the case of certain of our very destructive fungi. Of a series of some 50 species which we have tested in our laboratory none would grow above 118 deg. F. However, this does not necessarily mean that they would be quickly killed at this temperature.

Fungus in wood is often very long lived in timber dried in the air at moderate temperatures. Once it gets well distributed throughout the wood it is doubtful, in

*Abstracted from a paper presented before the Western Society of Engineers at Chicago on November 13, 1916.

very many cases, whether the wood can again become free of infection as a result of natural atmospheric conditions. One case on record shows that a stick infected with one of our common species contained a very vigorous growth after having been kept in a warm dry room for four years.

The second stage in the life cycle of a wood destroying fungus consists in brackets or shelves, "toadstools," or often only compact incrustations which appear on the surface of the timber after decay has become well started. Their function is to produce spores, which are comparable to the seeds of ordinary green plants. Being very minute (finer than flour) these spores are readily carried about by air currents and, lodging on the surface of moist timber, at a favorable temperature, start new growths. The number of spores produced is beyond the ordinary comprehension, the amount produced by a single specimen of this fungus in the course of a year has been estimated at "some fifty times the population of the globe."

A large part of the infection of timbers in the open occurs through the agency of these spores, but in buildings, where fruit bodies are less likely to develop, they play a less important role.

DECAY IN BUILDING TIMBERS.

The principal causes for decay, fall roughly under the six following heads:

1—Placing non-durable timber in moist, ill-ventilated basements or enclosures beneath the first floor, or laying sills in direct contact with the ground.

2—Embedding girders and joists in brick or concrete without boxing the ends.

3—Placing laminated flooring in unheated buildings in a green or wet condition.

4—Covering girders, posts or laminated flooring with plaster or similar coating before being thoroughly dried.

5—General use of non-durable grades of timber in a green or only partially seasoned condition.

6—Use of even dry timber of low natural durability in

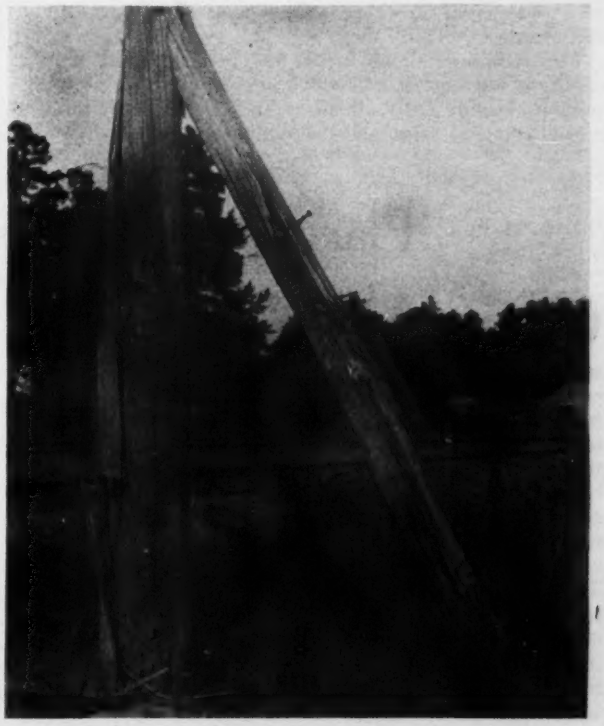
AN UNSANITARY LUMBER YARD

buildings artificially humidified to a high degree, as in textile mills.

A further element of danger lies in the use of timber infected during storage or which has become infected through neglect after purchase and delivery.

There seems to be some divergence of opinion regarding the use of laminated flooring. In many buildings it has proven completely satisfactory. In others it has given very poor service. All the complaints investigated by the writer have shown the trouble to be due to the use of wet material. This, at best, dries very slowly in an unheated building. Covering such timber with plaster, or any other heavy coating, when moist will almost invariably cause trouble. If difficulties with laminated flooring are to be avoided the timbers will have to be thoroughly air seasoned and kept dry during construction.

This leads us to a consideration of the advisability of covering materials in mill-constructed buildings. A num-



INTERIOR DECAY IN A TELEGRAPH POLE

ber of cases already investigated indicate clearly that the practice should not be recommended except with extreme caution, and a close knowledge of the condition of the timber as it goes into the building. A building was erected about 3 years ago in which the construction was under way throughout the winter, so that the timbers were subject to periodic wetting from rains and snow, the timbers being for the most part of poor quality, low density, mostly rapid growth, very knotty and often with a large proportion of sapwood. Laminated floors of mixed quality, usually sappy and wide-ringed southern pine, scant 3 in. by 6 in. in size were laid throughout the building, with the ends resting directly on the girders, with about a 5-in. bearing. The ceilings, girders and posts were all encased in plaster board leaving a narrow air space between the board and timbers.

This combination of circumstances—low quality timber, high moisture content and plaster board covering—caused the timber to rot rapidly, particularly at the bearings of the laminated floor on the girders.

HOW TO CONTROL DECAY.

The possibility that timber may reach the consumer with infection already in it is by no means remote. Many lumber yards are in a highly unsanitary condition as regards the presence of destructive fungi. For this reason the material should be carefully inspected and all pieces bearing incipient rot rejected. Likewise, it may prove advisable to inspect the yard where the purchase is made.

Upon delivery of the material it should not be thrown about on the ground but should be carefully placed on skids and kept dry. The soil is often a prolific source of infection.

Such timbers as are to be placed in situations favorable to decay should either be select grades of naturally durable stock or else treated with a good wood preservative. Neither non-durable timber or sapwood is objectionable when used in a dry condition and kept dry. Hence, every effort should be made during construction to keep moisture away from the timbers, and especially from around the joints.

Moist timbers should never be cased in, nor should timber of any sort be embedded in concrete or brick walls without boxing. In all cases thorough ventilation of moist, stagnant basements should be provided.

Whenever timbers begin to fail the need of a thorough inspection of the building is indicated. If poor ventilation is the cause the building should be opened up to secure rapid drying of the timbers. Where serious and active decay exists, without the exact method of control being indicated, the timbers should be carefully removed and replaced with select durable stock or with lower grade material treated with antiseptics. Likewise all incipient infection which appears in timbers which it is not considered necessary to remove should be given two or three applications of a wood preservative. Either a hot 3 to 4 per cent water solution of sodium fluoride or a cold 1 per cent alcoholic solution of mercuric chloride is well suited to interior timbers. Exterior timbers, where odor and color are not objectionable can be satisfactorily treated with a good grade of hot coal tar creosote.

Placing Concrete in Cold Weather*

CONCRETE work is now carried on almost regardless of season and temperature. This is because the requirements leading to the success of concrete work done when temperatures ar low have become so generally known that users are now able to do concreting sometimes throughout the year. By observing some simple and easily applied rules for preparing concrete mixtures, then using a few simple means to protect the freshly-placed concrete, the resulting work will be just as successful as though carried on during periods of warmer weather.

Heat hastens the hardening of concrete; cold delays it. The effect of cold becomes noticeable in this respect when temperatures fall below 50 deg. F., and becomes more marked as temperatures continue to fall. The general opinion is that freezing will not injure concrete that has first had an opportunity to harden for at least 48 hours under favorable conditions. If, before early hardening takes place, concrete is allowed to freeze and thaw at short intervals, it will be damaged to some extent. As a rule, it will not show any serious effects from having once been frozen if, after it thaws out, it is not again frozen until early hardening is complete. But it is far better to protect the concrete from freezing for from two to five days, depending upon the degree of the cold, rather than to expose it to the possibility of freezing. Warmth and moisture are necessary to the proper hardening of concrete. Any means that will cause these two conditions to be present in cold weather, particularly during the period of early hardening, will lead to the success of concrete work done at such times, if all other good practice is also followed.

HEATING MATERIALS.

If sand and pebbles or broken stone and mixing water are heated, the mixture will be so warmed that more rapid early hardening will take place. Warmth given the concrete from heated materials can readily be held in it for some time—as long as may be necessary to complete early hardening—if it is placed quickly after mixing and at once protected in some one or more of the several ways that will be described later.

Additional heat is also developed in the mass as a result of changes taking place from the chemical combination of the cement and water. This also helps to keep up the temperature of the freshly-placed concrete and thus aids to protect it from freezing. As cement forms only a relatively small bulk of a concrete mixture, it need not be heated, but it should be stored where it will be protected from dampness and extreme cold.

Mixing water is the easiest of materials to heat. It can readily be heated to 150 deg. F., and kept at this temperature until used, by one of several methods. Two methods are in common use; one is to use live or exhaust steam from a steam boiler, and the other is to heat the water in tanks or kettles over a fire. On large jobs mixing water is usually heated by steam. If a steam engine is used to run the mixer, the exhaust steam is often allowed to discharge into a water tank that is a fixture on the mixer. This arrangement is satisfactory, but does not heat as rapidly as live steam.

Live steam, which is steam under pressure, furnishes more heat where considerable quantities of water are required at regular intervals. When live steam is used and the water has been heated as required, its temperature can readily be kept at the desired point by a regulating valve that will admit only enough steam to the water to keep it hot. Sand and pebbles or broken stone should be heated. A temperature not exceeding 150 deg. F. will generally prove sufficient. Too much heat will injure some kinds of sand and pebbles or broken stone, particularly limestone. On small jobs these materials are usually warmed by piling them over and around sheet iron cylinders, such as an old smokestack, a section of old iron sewer or culvert pipe, or an old steam boiler. A fire is built within and the materials to be heated piled around and upon this "stove." Sometimes a stove is built by using concrete blocks for a foundation and covering with a piece of sheet steel such as boiler plate. It is necessary to turn or rake over the materials frequently so that those nearest the fire will not become too hot and thus possibly injured, while at the outside and edges of the pile they may not be warmed.

Heating sand and pebbles or broken stone by steam has advantages over other ways. They may be piled directly on steam-heated pipe coils or the piles may be covered with tarpaulins and steam applied directly to the materials. The tarpaulins act to house in the piles and thus to hold the heat. With a steady supply of steam this method is quite effective. The pipes used are closed at one end and perforated along their lower side by numbers of very small holes. The other end of the pipe is connected to the source of steam supply by means of steam hose. The pipes are then stuck into the piles of materials and steam turned on.

While cold weather concreting is in progress, piles of sand and pebbles or broken stone exposed to the weather

*Abstracted from a bulletin published by the Portland Cement Association, Chicago.

should be kept covered with tarpaulins to prevent the materials from becoming water-soaked and possibly frozen solid if the temperature should drop suddenly.

THE USE OF SALT.

Water containing common salt, calcium chloride (chloride of lime) and a number of other chemicals will not freeze at the same temperature as water which contains none of these substances. For this reason, it was common when concrete work was first done in cold weather, to add salt to the mixing water to prevent the concrete from freezing. As not more than 10 per cent of salt can safely be used without danger of affecting the final strength of the concrete and as such a quantity of salt gives protection only against a possible drop of temperature of 10 deg. below freezing, the use of salt is not effective when cold is extreme. Besides, it does not accomplish the one thing most desirable, as it delays instead of hastens the hardening of the concrete. Salt is considered objectionable in reinforced concrete because it may corrode the reinforcing steel. It should not be used where the appearance of the finished work would be spoiled by the whitish deposit that may later appear on the surface. This deposit is commonly referred to as efflorescence and may be expected on work in which salt has been used.

PROTECTION TO BE GIVEN.

After forms have been cleaned of ice, snow and any particles of frozen concrete, and have been warmed, the concrete mixture should be placed immediately so that none of the warmth given to it by the heated materials will be lost. All of the work should be done as quickly as possible.

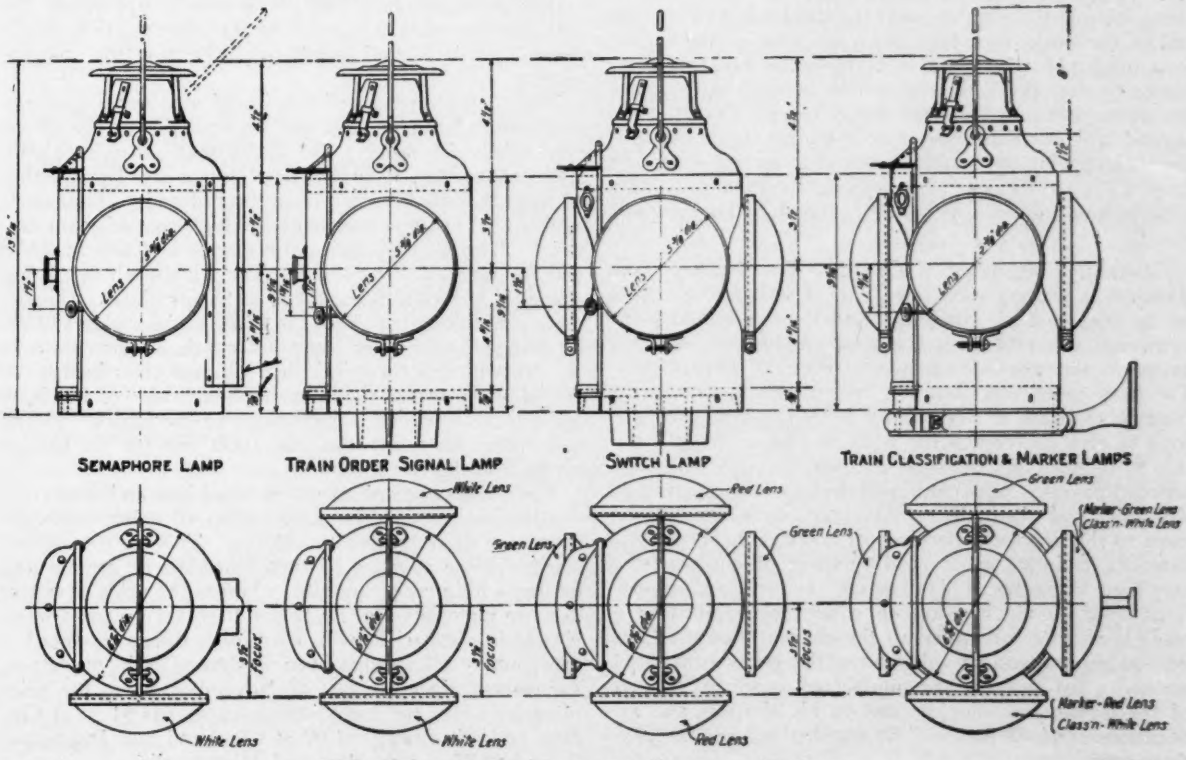
Thin floor slabs, beams, columns and similar classes of work have a large surface area compared with their volume; therefore, more careful protection must be given to such work than to foundations, abutments and other mass construction where the excavation or the bulk of the mass and heavy forms give part of the required protection. Floors are usually protected by a covering of hay or straw. Building paper or canvas should first be laid over the concrete, then from 6 to 12 in. of straw, depending upon the temperature to be protected against.

When forms are tight and made of heavy material, mass work may require no other protection than covering the concrete exposed at the top. This protection can be given by a layer of hay or straw, while vertical faces may be given additional protection besides that given by the forms by building a rough lattice work of strips 10 or 12 in. from the outside face of the forms and filling in between the lattice and forms with straw or manure. Such extreme measures are usually required only when the cold is very severe. If manure is used as a covering, it should never be placed directly upon the fresh concrete. It is not only likely to stain the work, but may injure the surface by creating a slight tendency towards pitting or scaling.

Forms should be left in place until it is absolutely certain that the concrete has become strong enough to be safe. Frozen concrete often has the appearance of being thoroughly hardened. If struck with a hammer it will ring just like hardened concrete. The work should be examined carefully before forms are removed. A single section of the forms or part of a section may be removed to expose the concrete, then the flame from a plumber's blow-torch, a jet of steam or hot water may be directed against the surface. If merely frozen the heat will thaw the water in the concrete, thus showing the condition of the work.

A STANDARD LAMP

THE Canadian Pacific has recently designed a standard lamp for use with switch, semaphore, train-order signal, train marker and engine classification lights, in which all parts have been made interchangeable as far



NEW STANDARD LAMP OF THE CANADIAN PACIFIC

as possible to decrease the amount of stock which it is necessary to keep on hand, and to facilitate the filling of requisitions for these materials. In these lamps one body is common to all, differing only in the number of lens openings. One size of lens (5⅜ in. in diameter), one type of door and one style of lamp top are common to all these lights. Likewise the bottoms of the switch and train order signal lamps are alike, while the train marker and engine classification lamps are identical, except for the color of the lens and for the fact that a blinder is used on the engine classification lamp to cover the lenses towards the center and rear of the engine. The semaphore lamp has the R. S. A. standard socket.

The engine classification and train-marker lamps can be used in any position, right or left. The semaphore and switch lamps are equipped with long-time burners and 31-oz. founts, while the train and train-order signal lamps are fitted with one-day burners. The lamps are made of 18-gage sheet steel and are provided with lenses of the standard colors. The general design of the lamp is shown in the accompanying drawing, which was prepared in the office of J. M. R. Fairbairn, assistant chief engineer, eastern lines.

CLEANING SNOW BY LOCOMOTIVES

DURING the severe storms of last winter the Chicago, Burlington & Quincy operated locomotives successfully in clearing snow and ice from interlocking plants and yard switches at Galesburg and Quincy, Ill., by means of steam without the aid of track laborers. As an example of the efficiency of the locomotive as a snow cleaner, on one occasion a single engine cleaned 80 switches in Quincy yard in about three hours, after a snowfall of one foot. To have done this work by hand would have required the services of 100 men.

All of the Burlington locomotives are equipped with globe valves on the steam dome for blowing out the boilers. A pipe is attached to this globe valve and carried along the top of the boiler, near the hand rail, to the front end of the smoke box, then down the front of the engine to a height of about one foot above the rail, and then across to the other rail with outlets at each rail. From the dome down to the near rail a 1½-in. pipe is used, beyond which a 1-in. pipe extends to just inside the further rail curving the smaller pipe out at an angle ranging from 22½ to 45 deg. In cleaning interlocking plants a locomotive equipped with a 50-ft. length of hose is used.

CENTRAL EMPLOYMENT OFFICE.—The Pennsylvania Railroad is making each one of the 1,500 station agents on its lines east of Pittsburgh and Erie an employment agent and is establishing a central employment clearing house in the general manager's office at Philadelphia. The purpose of this plan is to recruit employees in the country districts in accordance with the policy of the road to give preference for work to people living tributary to its lines and the smaller towns through which the railroad passes. Applicants will apply to the agent, who will interview them, learn their capabilities and direct them to the nearest supervisor of track or bridges, shop foreman, trainmaster or road foreman of engines, who may have vacancies at his disposal. If there are no positions open on the division on which the application is made it will be forwarded to the clearing house. Each general superintendent will send to the general manager, weekly, a list showing the number of vacancies in each of the branches of employment on his division, and applications received here will be matched against the positions open.

THE MATERIAL MARKET

NO better indication of the confidence in the continuation of the prevailing high prices is to be found than that indicated by the large tonnage of rail orders that has been placed in the last four weeks. The fact is particularly emphatic when it is recalled that these orders have been given shortly after the $5 advance in the price of steel rails was announced, which became effective in November. Nearly three-quarters of a million tons of rails were ordered in the first two weeks of December, with prospect of other additional orders, including one of over 200,000 tons from the Pennsylvania Railroad. Among the orders which have been recorded since the beginning of the month is one of 175,000 tons for the New York Central and one of 110,000 tons for the Frisco. The Missouri, Kansas & Texas has ordered 47,000 tons, the Illinois Central 55,000 tons, the same amount is reported for the Chicago, Milwaukee & St. Paul and 95,000 tons for the Santa Fe.

One of the most pronounced advances during the past month was in the field of track fastenings. The first week in December, Chicago prices for track spikes increased from an average of about $2.85 to $3.40 and a similar advance took place in Pittsburgh the following week. This overcomes the criticism of the iron trade to the effect that prices on spikes have been too low in proportion to those on other products. No change has taken place in the quotation for standard track bolts since the sharp advance in November, when the Pittsburgh price rose from $3.25 and $3.50 to $4.50 and $4.75. The Chicago price for tie plates is stationary at $55 and $60 per ton. Another recent advance of note was that on cast iron pipe, the increase ranging from $8 to $10, or an average increase of 30 per cent.

The most important advance, however, from the point of far-reaching influence was that in iron ore. Late in November the price advanced $1.50 per ton, or an increase of from 12 to 14 per cent. As these figures are higher than any since 1887, it is easy to appreciate the influence that they will exert on the general prices of all classes of iron and steel products for the coming year.

The contract prices of fabricated structural steel are gradually advancing, but not because the bridge shops are loaded with orders. On the contrary, they have only a limited amount of business and only a small proportion of what they have comes from the railroads. The prices in this field are up because of the high cost of plain material. The Chicago price for shapes is $3.19 to $3.57 and for plates $3.69 to $4.25. The Pittsburgh figure for shapes is $3 to $3.25 and $4.50 to $5 for plates. Chicago stock quotations for shapes is $3.70 and for plates $4.35, no change having taken place this month. Recent contracts for railroad structures include a Chicago river bridge for the Illinois Central, the New London bridge of the New Haven, the Kennebec river bridge of the Maine Central, and orders for 6,500 tons and 3,000 tons for the Lehigh Valley and the Burlington.

The continual climb of prices of all iron and steel commodities is causing the substitution of other materials wherever the opportunity affords. This in turn is resulting in the advance of such materials as cement and lumber within recent months, whereas the price advances in these materials previously had been very modest when viewed in comparison with most other things produced in this country. There has been no change in the quotations for cement since the last of November, when the price in carload lots, not including package, was $1.56 at Chicago and Pittsburgh, $1.69 at Cleveland and Indianapolis and $1.83 for St. Paul and Minneapolis.

GENERAL NEWS DEPARTMENT

THE TENTH ANNUAL CEMENT SHOW will be held at the Coliseum, Chicago, February 7 to 15 inclusive. The exhibition will be housed under one roof, the balcony as well as the main floor and annex being used.

THE UNITED STATES CIVIL SERVICE COMMISSION announces an examination for senior structural engineer, Grade 1, with the Interstate Commerce Commission at salaries ranging from $3,000 to $4,000 per year. The candidates will not be required to report for examination at any point, but will be rated 30 per cent on education and training, and 70 per cent upon experience.

THE ATCHISON, TOPEKA & SANTA FE announced on December 5 that bonuses amounting to 10 per cent of the salary for the year and aggregating $2,750,000 would be distributed to employees who have been in the service for at least two years, whose annual compensation does not exceed $2,500 and whose compensation is not paid according to present or former schedules or contracts.

THE INDIANA APPELLATE COURT held, in a recent decision, where a foreman placed two gangs at work 32 ft. apart, spiking rails, and the rear gang worked up to the other, causing one man to be struck by a sledge, that the railroad was not chargeable with having placed the men in a dangerous place, in the absence of orders to work together, or with knowledge that the two gangs had worked together.

THE INTERSTATE COMMERCE COMMISSION has issued an order that all common carriers subject to the provisions of the act to regulate commerce are required hereafter to file in the office of the commission on or before March 31 in each year, reports covering the period of 12 months ending with December 31, giving the particulars heretofore called for in the annual reports required by the commission.

THE BUFFALO, ROCHESTER & PITTSBURGH enters a letter of commendation on an employee's record and places his name on the roll of honor which appears in each issue of the monthly Employees' Magazine when he performs some act of more than ordinary merit. During the past four years over 1,000 names have been placed on this roll. Having a place on this honor roll stamps an employee as alert, observing and interested.

THE FIVE-MILE CONNAUGHT TUNNEL of the Canadian Pacific, through the Selkirk Mountains in British Columbia, has been opened for traffic. This marks the completion of the longest railway tunnel in the Western hemisphere. Construction also set a new record in tunnel driving, a novel and previously untried method being used which involved the use of an auxiliary or pioneer heading entirely outside the tunnel proper.

THE PENNSYLVANIA RAILROAD has issued an illustrated calendar with a drawing showing a typical crowd of school children hurrying across the tracks instead of crossing over a nearby bridge. This is a step in the campaign which this road is conducting to impress children with the dangers of playing on or crossing railroad tracks at other than the regular crossings. This calendar is being distributed throughout the schools along the lines of the Pennsylvania System.

THE RAILROAD YOUNG MEN'S CHRISTIAN ASSOCIATIONS of North America in their recent membership campaign for 30,000 new members far exceeded the expectations of the promoters, and secured 38,124 new members. This is an addition of 42 per cent to its membership and brings the present enrollment to between 125,000 and 130,000. The record for a single association was established at Trenton, N. J., where 1,521 new men were enrolled, and the record for any one railroad went to the Pennsylvania, with a total of 8,874.

THE OKLAHOMA STATUTE of 1910 requires that any employee of a public service corporation doing business in that state, upon his discharge or the voluntary termination of his services, is entitled to have issued to him a service letter; but the Oklahoma Supreme Court holds that before a corporation will be guilty of any breach of duty in failing to issue a service letter, request for it must be made by the employee either orally or in writing, served personally or by mail upon the superintendent, manager or contractor of the corporation.

THE 720-FT. SPAN of the Metropolis (Ill.) bridge over the Ohio river has just been swung clear of the falsework, thereby marking the successful erection of the longest simple span in the world. This bridge forms an important link in the Paducah & Illinois railroad, a 12-mile line connecting the Chicago, Burlington & Quincy with the Nashville, Chattanooga & St. Louis, and owned jointly by the two companies. The long span weighs 4,000 tons, and was erected from falsework requiring the use of over 600 piles. Aside from its record length, the structure is notable for the use of silicon steel in all the main compression members.

FRANK WIGHTMAN, superintendent of safety of the St. Louis-San Francisco, is inducing schools along the railroad to change their time of assembly, recess or dismissal if it coincides with that of fast trains. At many points Mr. Wightman has arranged with the schools to assemble earlier than the time of the arrival of a fast train. For instance, if a school assembled at nine o'clock, and a train passes through the town at that hour, the assembly time has been made 8:45, school being dismissed a quarter of an hour earlier. At another point a recess has been postponed until a fast train has passed.

CONGRESS is receiving a large number of petitions from railway employees, not members of the brotherhoods, asking that they be included in the provisions of the eight-hour law. Senator Newlands presented in the United States Senate on Wednesday, December 6, a petition signed by Robert T. Frazier, as chairman of the committee, and 300,000 railway employees in the "eighty per cent" movement, started on the part of those not members of the brotherhoods, asking the appointment of a commission to investigate and fix hours and wages of all railway employees and for compulsory arbitration of disputes over wages and hours.

THE ILLINOIS SUPREME COURT held, in an action for money due a contractor from a railroad, that a final estimate for an amount due the contractor made by a subordinate engineer in immediate charge of the work was not binding on the railroad company, the railroad construction contract providing that the amount finally due the contractor should be estimated by the railroad's chief engineer. By the contract the monthly estimates were not binding for any purpose. It was further held that the making of monthly payments on estimates made by the engineer in charge, and approved by the chief engineer, did not stop the railroad company from rejecting the subordinate engineer's final estimate.

BULLETIN 190 of the American Railway Engineering Association, which has just been issued, contains a list of over 1,400 references to discussions of the valuation of steam railways compiled by the Bureau of Railway Economics at Washington, D. C. This bibliography consists of 150 pages and is arranged under the following heads: general discussion, uses and purposes, methods and bases, items to be valued, land valuation, concessions, donations, grants of rights, etc., treatment of property constructed by investing surplus earnings, treatment of adaptation and solidification of roadbeds, depreciation, the federal valuation, state valuation and valuations of individual companies.

ALL THE ROADMASTERS on the eastern lines of the Canadian Pacific made an inspection trip recently by special train from Ottawa to Stanbridge. The party met at Ottawa and traveled over a high-speed single-track passenger line from Ottawa to Vaudreil, then over the double-track main line to Farnham, thence to Stanbridge over a light traffic branch line. The train consisted of a standard observation car, an official car and a dining car. The 38 roadmasters in the party were accompanied by the assistant general manager, the engineer maintenance of way, the assistant engineer maintenance of way, the general superintendent and a division superintendent.

PERSONAL MENTION

ENGINEERING

A. C. EVERHAM, engineer of construction for the Kansas City Bridge Company, has been appointed terminal engineer of the Union Pacific at Kansas City, Mo.

C. E. WEAVER has been appointed engineer maintenance of way of the Central of Georgia, with headquarters at Savannah, Ga., succeeding C. P. Hammond, assigned to other duties.

C. R. HARDING, chief draftsman in the office of the consulting engineer of the Southern Pacific at New York, has been appointed assistant to the consulting engineer, with office at New York.

J. H. REEDER, resident engineer of the Canadian Pacific at Schreiber, Ont., has been transferred to Smiths Falls, Ont., succeeding T. B. Ballantyne, who replaced Mr. Reeder at Schreiber.

N. B. WILKINS has been appointed assistant to the division engineer of the Toledo & Ludington division of the Pere Marquette with headquarters at Saginaw, Mich., succeeding L. I. Tefft, promoted.

W. M. JACKLIN, supervisor of roadway of the Canadian Pacific at Hornepayne, Ont., has been appointed inspector of maintenance of way for lines east of Port Arthur, with headquarters at Toronto, Ont.

J. H. SCHUCH has been appointed chief engineer of the Butte, Anaconda & Pacific, succeeding Charles A. Lemmon, who resigned some time ago to enter the service of the Anaconda Copper Company, Anaconda, Mont.

R. S. CLAAR, assistant engineer on the Duluth, South Shore & Atlantic, has been appointed office engineer with headquarters at Duluth, Minn., succeeding J. E. Bebb, resigned to accept service with another company, effective January 15, 1917.

E. L. CRUGAR, assistant engineer of the Illinois Central, with office at Chicago, Ill., has been appointed district engineer, with office at New Orleans, La., succeeding C. E. Weaver, appointed engineer maintenance of way of the Central of Georgia.

M. KELLY, resident engineer in charge of the Toronto terminals of the Canadian Pacific, has been appointed resident engineer at Farnham, Que., succeeding D. A. Wallace, who has resigned to accept a position with the Canadian government at Ottawa.

E. G. LANG, the announcement of whose appointment as division engineer of the Missouri, Kansas & Texas, with headquarters at Oklahoma City, Okla., was made in these columns last month, began his railway career as a water boy for a section gang. In the summer of 1890 he worked as a section hand with the St. Louis Southwestern, and at the age of 16 he was promoted to section foreman at Alto, Tex. Two years later he went with the International & Great Northern as a section foreman and a year later he entered the employ of the Missouri, Kansas & Texas in this same capacity. He was appointed roadmaster at Waco, Texas, in 1906, and after serving in other divisions in Texas he was transferred to Parsons, Kan., as roadmaster, in 1910. In August, 1911, he was made supervisor of maintenance of way, with office at St. Louis, Mo. This position was abolished in August, 1912, and he was transferred to the Dallas division, where he remained until he was appointed division engineer, with headquarters at Oklahoma City, Okla., as noted above.

E. G. LANG.

B. J. SIMMONS has been appointed division engineer of the Arizona division of the Atchison, Topeka & Santa Fe, with jurisdiction over maintenance of way, bridge and building and water service matters, effective December 14, succeeding W. L. Bradley, transferred.

GEORGE F. BLACKIE, engineer of roadway and track of the Nashville, Chattanooga & St. Louis at Nashville, Tenn., has been appointed assistant chief engineer. H. H. Trabue, formerly assistant chief engineer and real estate agent, now becomes real estate agent, reporting directly to the president.

E. L. CANNON was appointed office engineer of the Seaboard Air Line with headquarters at Norfolk, Va., effective December 10. He entered the employ of the Norfolk Southern as assistant chief clerk in 1902 and was promoted to supervisor of roadway and track a short time later. He left this road to become chief clerk to the chief engineer of the Seaboard Air Line in October, 1905, which position he held until his appointment as office engineer as noted above.

TRACK

H. H. STANLEY was appointed roadmaster of the Atchison, Topeka & Santa Fe at Ellinwood, Kan., succeeding Arthur Jung.

J. T. CURRAN has been appointed roadmaster of the Atchison, Topeka & Santa Fe, with office at Center, Tex., succeeding J. C. Rogers.

R. J. YOST has been appointed roadmaster of the Atchison, Topeka & Santa Fe, with headquarters at Chillicothe, Ill., succeeding John Henberger.

J. B. ALLEY has been appointed roadmaster on the Clinch Valley district of the Norfolk & Western, with headquarters at Bluefield, W. Va., succeeding R. M. Wilson, who has been appointed general yardmaster with jurisdiction over the Tug Fork branch with headquarters at Wilcoe, W. Va.

AUGUST FREDERICKS, track foreman on the Chicago and Council Bluffs division of the Chicago, Milwaukee & St. Paul, has been appointed acting roadmaster, with headquarters at Elgin, Ill., succeeding W. H. Kofmehl, resigned, effective December 15, to become associated with the Thomas Track Appliance Co., Kansas City, Mo.

J. TELFORD, roadmaster on the Canadian Pacific at Kingston, Ont., has been transferred to Havelock, Ont., succeeding J. Malloy, who has been pensioned. J. Goodman, roadmaster at Orangeville, Ont., has been transferred to Kinston and W. Milliken, extra gang foreman on the Galt subdivision, has been promoted to the position of roadmaster at Orangeville, succeeding Mr. Goodman.

HANNIBAL H. STANLEY has been appointed roadmaster of the Atchison, Topeka & Santa Fe, with headquarters at Ellinwood, Kan., effective November 27. He was born at Atchison, Kan., on December 21, 1860. After receiving a common school education he entered railway service as a laborer with the Union Pacific in 1895. Two years later he was promoted to section foreman, which position he held until July, 1906, when he entered the employ of the Atchison, Topeka & Santa Fe in this same capacity at Oak Hill, Kan. When appointed roadmaster he succeeded Arthur Jung, resigned to accept a position as roadmaster with the Missouri, Kansas and Texas at Parsons, Kan.

BRIDGE

GEORGE MERCER, general foreman of bridges and buildings, has been appointed superintendent of bridges and buildings on the Duluth, South Shore & Atlantic, effective January 1, 1917.

J. E. BEBB, office engineer of the Duluth, South Shore & Atlantic, with headquarters at Duluth, Minn., has been appointed assistant bridge engineer of the Michigan Central, with headquarters at Detroit, Mich., effective January 15, 1917.

LUTHER I. TEFFT, assistant engineer of the Pere Marquette, with headquarters at Saginaw, Mich., has been appointed assistant to the engineer of bridges and structures. He was born October 30, 1885, at St. Charles, Mich. After leaving high school he worked as a rodman in the coal mines in Saginaw county, Michigan. A little later he did some private engineering work in Spokane, Wash., and then entered railway service as a

draftsman with the Gilmore & Pittsburgh at Armstead, Mont. After a short period of service with the Chicago, Milwaukee & St. Paul as a draftsman he was employed by the Spokane General Engineering Company of Spokane, Wash., as a transitman. In 1911 he went to the Pere Marquette as a transitman, and the following year was employed by the city of Saginaw, Mich., in a similar capacity. Later he was transitman and chief of survey on the work done for this city by the Fargo Engineering Company of Jackson, Mich. On September 1, 1916, he was appointed assistant engineer on the Pere Marquette, with office at Saginaw, Mich., which position he held up to the time of his present appointment as assistant to the engineer of bridges and structures, effective November 18, 1916.

PURCHASING

A. H. MULCAHEY has been appointed purchasing agent of the Grand Trunk Pacific, with office at Winnipeg, Man.

W. A. LINN, assistant purchasing agent of the Chicago, Milwaukee & St. Paul, with office at Chicago, Ill., has been appointed purchasing agent, succeeding John T. Crocker, retired.

E. O. GRIFFIN, purchasing agent and general storekeeper of the International & Great Northern, with office at Houston, Tex., has been appointed general purchasing agent of the St. Louis Southwestern, with headquarters at St. Louis, Mo.

C. B. PORTER, chief clerk to the receiver of the International & Great Northern, has been appointed purchasing agent and general storekeeper, with office at Houston, Tex., succeeding E. O. Griffin, resigned to accept service with another company.

OBITUARY

T. E. CALVERT, chief engineer of the Chicago, Burlington & Quincy, died at his home in Lincoln, Neb., on December 19 from a lesion of the heart. While sick only a short time, he had never recovered entirely from a serious motor car accident at Douglas, Wyo., over a year ago. He was born at Newton Square, Pa., on September 10, 1849. After graduating from the Sheffield Scientific School of Yale University in 1870, he entered the service of the Chicago, Burlington & Quincy as an axeman at Portsmouth, Neb., on April 1, 1871. He was later promoted to assistant engineer, and in 1878 was made chief engineer of the lines west of the Missouri river, with headquarters at Lincoln, Nebr. In 1884 he was appointed general superintendent of these same lines. In 1904 he was made chief engineer of the Burlington system, with headquarters in Chicago, which position he held until his death. Mr. Calvert was identified with the development of a large part of the Burlington system, and with practically all of the lines west of the Missouri river. At the time he entered the employ of the road it owned but 26 miles of line west of Omaha, while it now owns over 4,700 miles. At the time he became chief engineer of the lines west of the Missouri river, the extensions to Denver and to Billings, Mont., were under way, and the large number of branch lines has been added. After becoming chief engineer he had charge of all important improvement work, including the development of low grade lines from Savanna, Ill., south through the Illinois coal fields to Paducah, Ky., and from Billings, Mont., through the Big Horn Basin of Wyoming to Orin Junction, where connection was made with the existing lines of the Burlington and the Colorado & Southern. He was also in charge of the development of the terminal plans for the Burlington at Chicago, in connection with the construction of the Union Station, which is now under way.

T. E. CALVERT.

CONSTRUCTION NEWS

THE ATCHISON, TOPEKA & SANTA FE will soon award contracts for grading, bridge work, track laying, fencing and buildings required for the North Texas & Santa Fe extension from Shattuck, Okla., southwesterly 82 miles to a point in Hansford county, Tex. The company will furnish the track and bridge material. Approximately 2,500,000 cu. yd. of excavation, 2,800 lin. ft. of trestle bridging and 400 ft. of steel bridging will be required. Four frame combination depots containing agents' cottage, section and bunk houses and water stations will also be built in addition to one 3-stall engine house.

This company is calling for bids for the Brownfield extension of the South Plains & Santa Fe from Lubbock, Tex., to a point about 24 miles southwest of Brownfield, Tex., a distance of 64 miles. The company will furnish the track and bridge material only, the other work to be let by contract. Approximately 1,000,000 cu. yd. of excavation, 650 lin. ft. of bridging, three small combination depot buildings and section and bunk houses and a water station and a 3-stall engine house will be required.

This company and the Chicago, Rock Island & Pacific have awarded a contract to the H. D. McCoy Company, Cleburne, Tex., to construct a union passenger station at Ardmore, Okla. The building will cost $40,000 and will take the place of the one destroyed by fire in September, 1915.

THE CHICAGO, BURLINGTON & QUINCY has secured the approval of the Missouri Public Service Commission to build a line from Monroe City, Mo., to Moberly, a distance of 40 miles, and from Mexico to Moberly, 36 miles. The Burlington is also negotiating with the Santa Fe regarding the building of a line from Carrollton to Moberly, 60 miles, which will give both roads a low grade line from Kansas City to St. Louis, and the Burlington a low grade line from Kansas City to Chicago.

THE CHICAGO & NORTHWESTERN has accepted the provisions of an ordinance passed by the city council of Clinton, Iowa, which permits this company to erect a new passenger station, two subways and a new freight depot at this point. It is estimated that the cost of this work will be close to $500,000, and that it will require about three years to complete. Construction plans for another passenger station, to be used by the Chicago, Rock Island & Pacific, the Chicago, Burlington & Quincy and the Chicago, Milwaukee & St. Paul, are also under consideration. The Northwestern station will be connected to this second station by subways, giving the city the benefit of a union station.

THE GULF, COLORADO & SANTA FE and the other railroads entering Galveston, an interurban and the county, have decided upon the re-construction of the portions of the causeway across Galveston Bay destroyed in the storm of August, 1915. Reinforced concrete arches of a total length of 5,900 ft. will be built at the two ends of the present causeway at an estimated cost of $1,500,000, exclusive of track. It is expected that contracts will be let and the work will be undertaken in the spring.

THE NORTHERN PACIFIC is planning to double track its line from Rice, Minn., to Little Falls, a distance of about 17 miles. No definite time has been set for the beginning of the work, nor have any contracts as yet been awarded.

This company has awarded a contract to Grant, Smith & Co., Spokane, Wash., to construct about 35 miles of new line from a point 12 miles west of Billings, Mont., into the wheat growing area northwest of Laurel.

THE NORFOLK & WESTERN proposes to build new freight house facilities at Roanoke, Va., which will occupy a space about 200 ft. wide and 1,500 ft. long, bounded by Commerce street, Ernest avenue, Park street, and the present main tracks of the Norfolk & Western. The plans include a two-story brick freight office building, 50 ft. by 140 ft., a freight wareroom 55 ft. by 740 ft. of brick and steel construction, having wide rolling steel doors, two covered transfer platforms 18 ft. wide and 800 ft. long. The approximate cost of the improvements is $380,000.

THE PENNSYLVANIA LINES WEST have awarded a contract to John C. Herndon & Co., Akron, Ohio, to construct a third track from Leetonia, Ohio, to Salem, a distance of five miles. The work will include track laying and bridging, approximately 140,000 cu. yd. of steam shovel work, and about 40,000 cu. yd. of team work.

THE SALT LAKE, GARFIELD & WESTERN, until recently called the Salt Lake & Los Angeles, plans soon to extend its line to Garfield, Utah, and then electrify its entire system. No engineering or construction work has as yet been done, nor have any contracts been let, although orders have been placed for rails, ties, poles and other equipment necessary for electrification.

STRUCTURAL STEEL

THE CENTRAL OF NEW JERSEY has ordered 1,200 tons of steel from the Phoenix Bridge Company for a new passenger station at Newark, N. J.

THE CHICAGO, BURLINGTON & QUINCY has ordered 3,000 tons of steel from the American Bridge Company for the Harrison street freight terminal buildings in Chicago.

THE ILLINOIS CENTRAL has purchased 1,500 tons of structural steel from the American Bridge Company for the construction of a single leaf Strauss bascule bridge, 260 ft. long, over the south branch of the Chicago river on the St. Charles Air Line. About 3,000 cu. yd. of masonry will be placed, for which bids will be asked on or before March 1, 1917. The estimated cost of the entire project is $350,000.

THE MAINE CENTRAL has ordered 4,000 tons of steel from the McClintic-Marshall Company for a bridge over the Kennebec river at Augusta, Me.

THE NEW YORK, NEW HAVEN & HARTFORD has ordered 7,000 tons of steel from the American Bridge Company for the superstructure for the Thames river bridge at New London, Conn.

TRACK MATERIALS

THE ATCHISON, TOPEKA & SANTA FE has placed orders for approximately 95,000 tons of steel rails for 1918 delivery. About two-thirds will be rolled by the Colorado Fuel & Iron Company and the balance by the Illinois Steel Company. Joints for these rails were ordered some time since.

THE CHICAGO & NORTH WESTERN has ordered 40,000 tons of rails from the Illinois Steel Company for 1918 delivery.

THE CHICAGO, MILWAUKEE & ST. PAUL has ordered 55,000 tons of steel rails and accessories for 1918 delivery. It is reported that most of these rails will be rolled by the Illinois Steel Company.

THE ERIE has placed orders for 40,000 tons of rails.

THE ILLINOIS CENTRAL has ordered 55,000 tons of steel rails for 1918 delivery, 32,000 tons going to the Illinois Steel Company and 18,000 tons to the Tennessee Coal & Iron Company. An additional 5,000 tons has been ordered for switch and frog work.

THE MINNEAPOLIS, ST. PAUL & SAULT STE. MARIE has ordered 50 miles of 85-lb., open hearth rail from the Illinois Steel Company for 1918 delivery.

THE MISSOURI, KANSAS & TEXAS has ordered 47,000 tons of rails for 1918 delivery.

THE NEW YORK CENTRAL has divided orders for 175,000 tons of rails among the Illinois Steel Company, the Lackawanna Steel and the Bethlehem Steel Corporation. It is understood that the Bethlehem Steel Company was given 10,000 tons, the remainder of the order being divided equally between the Illinois and Lackawanna companies.

THE PACIFIC GREAT EASTERN, through its agents, Evans, Coleman & Evans, Ltd., Vancouver, B. C., has ordered 20,000 tons of rails and necessary accessories for 1917 requirements from the United States Steel Corporation.

THE ST. LOUIS-SAN FRANCISCO has ordered 42,000 tons of rails for 1917, and 56,000 tons for 1918 delivery.

SUPPLY TRADE NEWS

PERSONAL

CHARLES B. MOORE has resigned as vice-president and director of the Boss Nut Company, Chicago, Ill.

A. J. BOYLE, formerly with the Pittsburgh Screw & Bolt Co., Pittsburgh, Pa., has been appointed general manager of the Boss Nut Company, Chicago, Ill.

CHARLES WILEY, vice-president of John Wiley & Sons, New York, publishers of scientific books, died at his home in East Orange, N. J., December 3, at the age of 83 years.

ARTHUR V. FARR, for the last three years advertising manager of the S. K. F. Ball Bearing Company, Hartford, Conn., has been appointed sales manager of the Hess Steel Corporation, Baltimore, Md.

F. C. YEATES, purchasing agent of the Cambria Steel Company, has also been appointed purchasing agent of the Midvale Steel Company, the Worth Brothers Company and the Wilmington Steel Company, succeeding H. L. Murphy, resigned.

FREDERICK C. FISHER, president of the Ferro Construction Company, Chicago, Ill., died at his home in that city on Tuesday, December 5. He was born at Lake Linden, Mich., on May 24, 1871. After graduating from the engineering college of the University of Michigan he entered the employ of the Detroit Bridge Company as a draftsman, and a short time later was employed by the American Bridge Works, Chicago, Ill. In 1899 he became identified with the Kelly-Atkinson Construction Company and in March 15, 1907, he was elected president of the Ferro Construction Company, Chicago, which position he held at the time of his death.

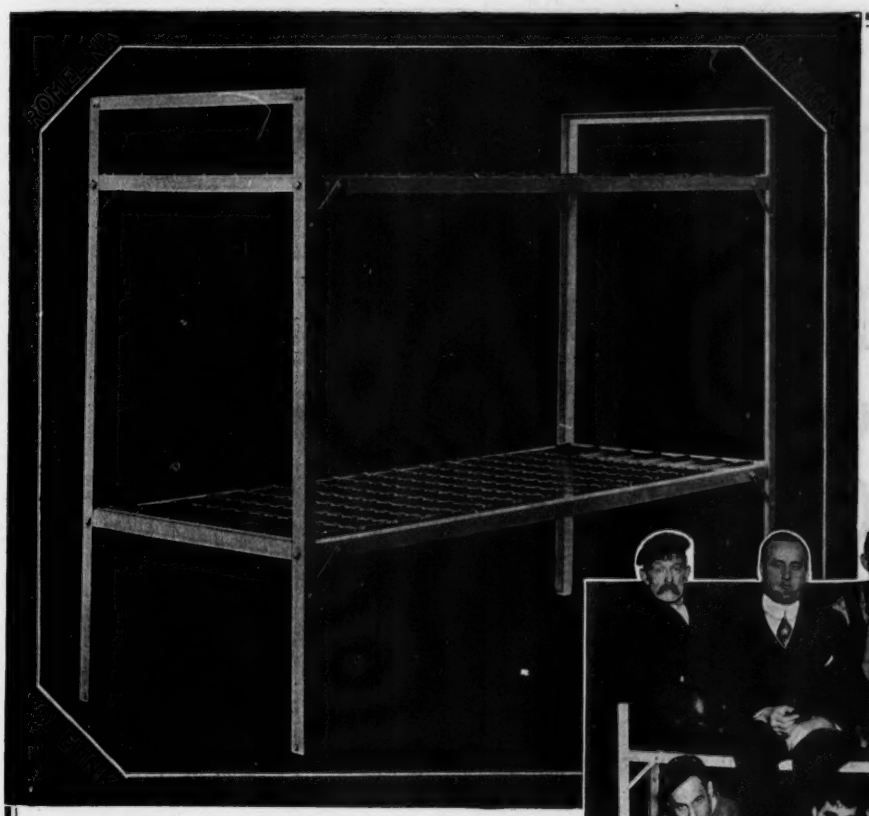
GENERAL

THE MISSOURI PACIFIC has awarded a contract for 9 water treating plants of the Miller type to the Railroad Water and Coal Handling Company, Chicago. These plants are similar in design to 35 inserted previously on this system. Upon their completion the main line between Kansas City and Pueblo, Colo., will be practically completely equipped with water treating facilities and the two engine districts extending from Hoisington, Kan., west 333 miles to Pueblo, Colo., will be completely equipped.

THE UTAH IRON & STEEL COMPANY, Midvale, Utah, plans to construct a new 40-ton open-hearth furnace, with continuous ingot heating furnaces and a 24-in. ingot breakdown mill. Round, square and flat bars, angles, channels and T-rails will be produced up to 30 lb. per yd. The capitalization of the company is $300,000, and the officers are as follows: C. W. Whitley, president; N. Rosenblatt, vice-president; S. A. Whitney, treasurer; S. Rosenblatt, secretary; H. G. Purcell, manager of sales.

THE UNITED STATES STEEL CORPORATION reported unfilled orders on hand November 30 as totaling 11,058,542 tons. This is again a new record, and the increase of 1,043,282 tons over the October 31 figures of 10,015,260 tons represents the largest gain yet made during a single month. At the present rate of production the total of unfilled orders will be sufficient to maintain full operations for at least seven months. Unfilled orders on September 30 totaled 9,522,584 tons; on August 31, 9,660,357 tons; on July 31, 9,593,592 tons, and on November 30, 1915, 7,189,489 tons.

THE RAIL JOINT COMPANY, New York, through its directors, has elected E. Y. Weber president, to succeed the late C. W. Hotchkiss. Mr. Weber was associated with the Weber Railway Joint Manufacturing Company before that company and others were consolidated to form the Rail Joint Company in 1905. Since that time he has been a member of the board of directors and of the executive committee of the Rail Joint Company. Other officers of the Rail Joint Company were elected as follows: Percy Holbrook, B. Wolhaupter and W. P. Thomson, vice-presidents; B. Wohlhaupter, secretary, and F. C. Runyon, treasurer.



Important

The illustration below demonstrates our repeated assertion as to the strength of the frame, as well as the resiliency of the springs of the "Romelink" Double Deck Angle Bunk. The total weight of these nine (9) men is 1,403 pounds. Three or four hundred pounds more could be placed on this bunk without any danger of failure.

This is not the only test the Romelink All-Metal Bunk will stand!

Besides the test of weight, there is the test of time, the effects of dampness and moisture, abuse and neglect. Romelink Bunks have passed through all of them unscathed, not only in submarines, but also down in Panama and in railway engineering work.

The all-metal bunk's the thing—it's the only solution to the problem of sanitation and comfort for your workmen. Romelink All-Metal Bunks are

Easy To Install — Easy To Keep Clean

Any day laborer can install them—scarcely any work at all, as they come knocked down. There are no crevices for vermin to collect, hence they are easy to keep clean. Springs are galvanized to prevent rusting, while their weave prevents sagging. All castings are malleable (not chilled) iron.

From these facts you can readily see why Romelink All-Metal Bunks are superior to wood bunks; why the United States Government uses them in submarines and down in Panama; also why one of the largest Eastern Railroads has installed them on its work trains.

For complete details, prices and literature, kindly fill out the coupon.

Southern-Rome Company

617-633 West Pratt Street

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SIGN AND MAIL TODAY

SOUTHERN-ROME COMPANY, Baltimore, Md.
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Without any expense to me, kindly send me details, blue prints and prices on Romelink All-Metal Bunks.

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Address.....

Railroad.....

Position.....

Are You a MAINTENANCE Man or a RAILROAD Man?

You know the details of maintenance of way work. You have the knowledge and the experience necessary for success in this specialized department of the railway industry.

However, are you looking to the future? Have you made a study of the problems outside of, but more or less directly connected with your department? On account of the close relation of track, bridge and other maintenance of way work to operation, such a study is essential to the highest grade of efficiency in your own department, and it also may prove a stepping stone to promotion into other departments having even greater opportunities. Therefore, whether you aspire to the best in this field or to executive positions beyond this department, it is necessary to understand the principles of construction, maintenance and operation.

The fact that you are a reader of the *Railway Maintenance Engineer* indicates that you are interested in keeping in touch with the latest developments in your field. The logical way to broaden your horizon is to add to your present habits the study of a paper which treats of railroading as a whole. The *Railway Age Gazette* offers this opportunity. It will give you a working knowledge of the fundamental principles of all departments.

If you have ambition, subscribe to the *Railway Age Gazette*. There is no better time to begin than the first of the year.

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There's a Vast Difference

between *properly* preserved creosoted cross-ties and just creosoted cross-ties

Make Them Last as Long as the Rails

THE ONE SURE WAY

to get decay-proof cross-ties is to use a pure, high-boiling, heavy-gravity, stable and non-volatile creosote oil that will not evaporate or leach from the wood. The manufacturers of

***REILLY* IMPROVED CREOSOTE**

The most effective OIL wood preservative, are the only manufacturers of creosote oil who claim to make a decay-proof, permanent, high-boiling, heavy-gravity, pure, non-leaching creosote oil, and who make their claim good.

"QUALITY FIRST" IS OUR SLOGAN

Reilly Improved Creosote Oil is pure. It contains no tar, asphalt, petroleum, paraffin or resin. It is stable, permanent, non-leachable. Its effectiveness can be measured only by the mechanical life of the tie.

You'll find long life in Ties, Bridge Timbers, Piling, Poles, Wooden Blocks for Freight House Floors and Loading Platforms when they are preserved with Reilly Improved Creosote Oil.

There is no substitute for timber that is effectively preserved from rot and decay; 81 per cent of all manufactured timber fails from these causes. Are you contributing to this waste?

Do not accept our claims unchallenged. In the interest of the creosoting industry in general we urge you to make first-hand investigation of the comparative merits of REILLY IMPROVED CREOSOTE OIL and that which you are using.

No order too small for our careful attention or too large for our capacity.

REPUBLIC CREOSOTING COMPANY

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Plants: Indianapolis Mobile Minneapolis Seattle

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Can be done and is being done on some of the best railroads in the country at a saving of 56% by the use of the

TRENCH-ZEPP STONE BALLAST CLEANER

Such economy well deserves your investigation.

Write for booklet of cuts and a copy of the latest report on Stone Ballast Cleaning by this new method.

LITTLEFORD BROS.

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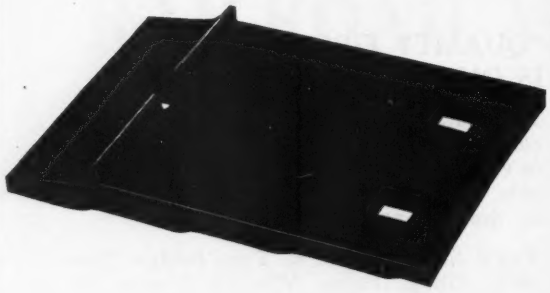


One of the most distinguished, successful and honored Engineers of the United States, while not wishing his name to appear in an advertisement, writes as follows of The

LUNDIE TIE PLATE

"It is by far the most scientifically designed and practically efficient tie plate ever evolved."

JOHN LUNDIE, 52 Broadway, NEW YORK

Down Come Maintenance Costs When O. G. Fir Gutters Go Up

Let that sink in, you men who strive to keep expenses down. Let O. G. FIR GUTTERS go up on your building, and you will not have to strive to keep maintenance and upkeep expenses down. The Gutters will attend to that for you.

E. M. LONG & SONS CADIZ OHIO IMPROVED O.G. FIR GUTTERS

O. G. FIR GUTTERS

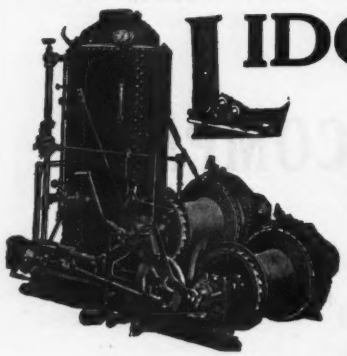
A quarter century or more of service without a dollar for repairs or renewals. That is how gutter service is *IMPROVED.* Why? It's simple enough, they are made of

Nature's Own Gutter Material Douglas Fir

Hence decay resisting and immune to the ravages of time and the action of the elements, smoke, water and chemical fumes.

O. G. FIR GUTTERS are built right into the building—they've been built right into the buildings of many progressive railroads, by the way—and they last. But send for new folder and learn why O. G. Fir Gutters effect double savings.

E. M. LONG & SONS,
CADIZ, OHIO



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For Pile Driving, Derricks, Bridge Erection, Coal Towers, Etc. Draw Bridge Engines, Ballast Unloaders, Excavators, Cableways

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Reliability and Economy

ARE SECURED BY THE USE OF

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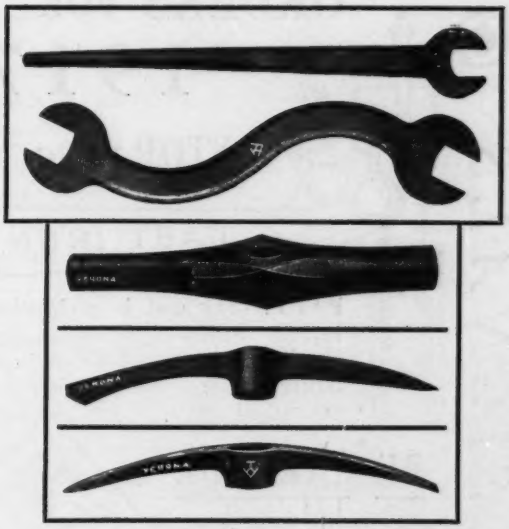

The Difference in Initial Cost is very soon made up by additional service they will give. Inspect your old track tools sent in for repairs and you will buy *Verona Chisels, Spike Mauls, Wrenches, Claw Bars, Adzes, Picks, Gauges, Levels, etc.*

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Tie Tongs

Weight, 15 Pounds

HUBBARD
Track Tools and Shovels

THE "Hubbard" trade mark on track tools and shovels is the means of identifying a superior product. Back of this trade mark is a reputation for integrity earned by half a century's successful effort to maintain the highest standard of quality.

If you will submit to us blueprints or sketches of special tools, we will give you the benefit of our experience in designing them for your particular needs.

Write for catalogues.

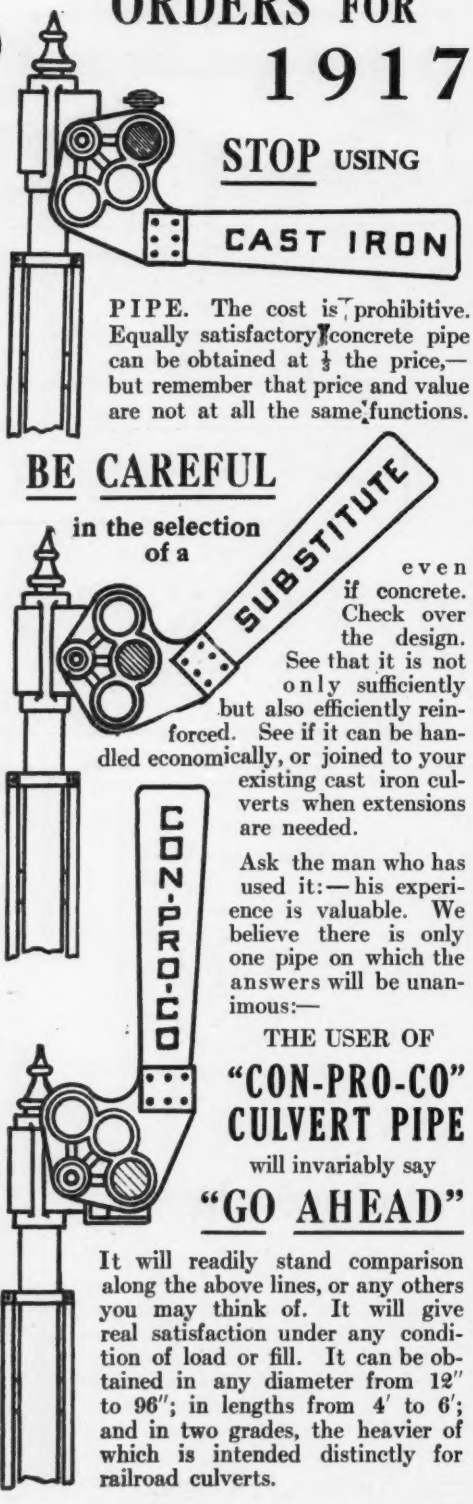
HUBBARD & COMPANY, :: Pittsburgh, Penna.

Claw Bar

Drain Spade

CULVERT PIPE ORDERS FOR 1917

WATCH ◎ YOUR ◎ SIGNALS ◎



STOP USING

PIPE. The cost is prohibitive. Equally satisfactory concrete pipe can be obtained at ⅓ the price,—but remember that price and value are not at all the same functions.

BE CAREFUL

in the selection of a

even if concrete. Check over the design. See that it is not only sufficiently but also efficiently reinforced. See if it can be handled economically, or joined to your existing cast iron culverts when extensions are needed.

Ask the man who has used it:—his experience is valuable. We believe there is only one pipe on which the answers will be unanimous:—

THE USER OF

"CON-PRO-CO" CULVERT PIPE

will invariably say

"GO AHEAD"

It will readily stand comparison along the above lines, or any others you may think of. It will give real satisfaction under any condition of load or fill. It can be obtained in any diameter from 12″ to 96″; in lengths from 4′ to 6′; and in two grades, the heavier of which is intended distinctly for railroad culverts.

Concrete Products Co. of Pittsburgh

Diamond Bank Building Pittsburgh, Pa.

Now Is The Time To Prepare For Spring Track Work

The increasing demand for "Imperial" Tie Tamping Outfits is significant.

Some railroads are adopting "Imperial" Tampers for track work on the grounds of the economy and improved quality of work which results—others are installing them as the only real solution of the track labor shortage problem; but both classes of purchasers are securing the double advantage.

The past year, the manufacturing department was taxed to its utmost to fill orders. Many railroads are anticipating the satisfactory accomplishment of spring track repairs, by placing their orders for "Imperial" Pneumatic Track Tampers now.

Gasoline driven compressor car operating two tamping machines.

Gasoline driven compressor car operating four tamping machines.

Electric motor driven compressor operating two tamping machines.

Pneumatic tampers for operation from switch or signal air lines.

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AIR COMPRESSORS PNEUMATIC TOOLS

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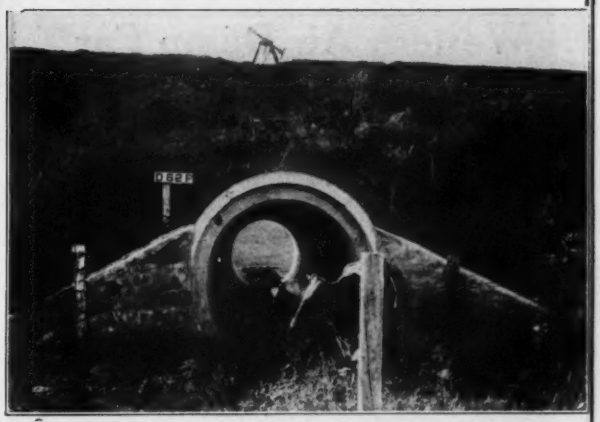
Massey products are permanent, fireproof, economical, and require absolutely no maintenance. They are made in modern well equipped plants and of the best material procurable.

Information and prices on our piles, bridge slabs, cattle passes, culvert pipe and other products will be furnished interested parties on application.



The advantageous location of our factories enables us to ship to all points at a low freight rate and the large stock of standard products carried at each factory insures prompt deliveries.

Our factories are located as follows:

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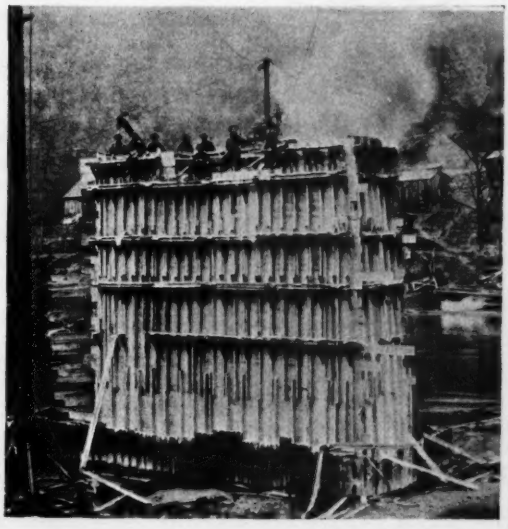
Chicago, Ill.	Anna, Ill.
Minneapolis, Minn.	Memphis, Tenn.
Meridian, Miss.	Chatham, Ont.

Steel for Service



The cofferdam for this pier for a Tug River Railroad Bridge near Matewan, W. Va., was constructed with

United States Steel Sheet Piling

The piling was driven through 26 feet of sand, gravel and blue clay, soft slate, coal, and into strata of very hard fire clay.

The leakage was slight and not sufficient at any time to interfere with excavation and placing of concrete in the dry.

When figuring on your next cofferdam job our trained engineers will be pleased to go into the matter of steel sheet piling with you.

Carnegie Steel Company

General Offices—Pittsburgh, Pa.

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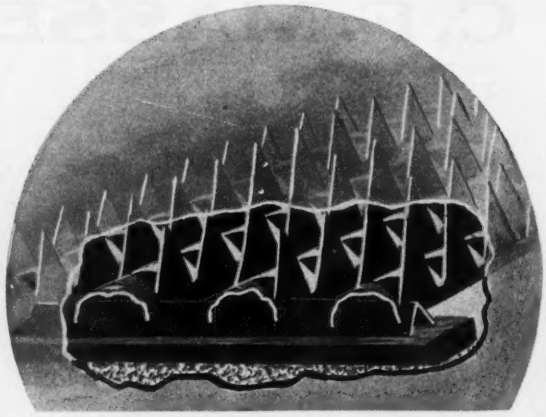
An Example of

Western Air Dump Car Economy

A certain western road had been handling cinders in A-frame dump cars on local trams. The crew of the local would pick up a section gang to do the unloading, which would keep both train crew and section gang from 30 minutes to one hour. Now with Western air dump cars the train crew does it all instantly and without any additional help.

Let us give you full information regarding the big economies in Railroad Ditching and Trestle Filling work.

Western Wheeled Scraper Co.
AURORA, ILL.



Absolutely Cattle-Proof

THE NEW 1917 MODEL

National Steel Cattle Guard

The new 1917 National Cattle Guard is absolutely cattle-proof. It is the crowning achievement of thirty years of steel cattle guard construction. A MECHANICAL DEVICE which will positively turn the most unruly stock. Made of best grade of Open Hearth Steel, No. 9 or No. 11 gauge, coated with secret-process, baked-on enamel. Impervious to rust and corrosion. The "National" is quickly and easily installed by unskilled labor. Will last indefinitely.

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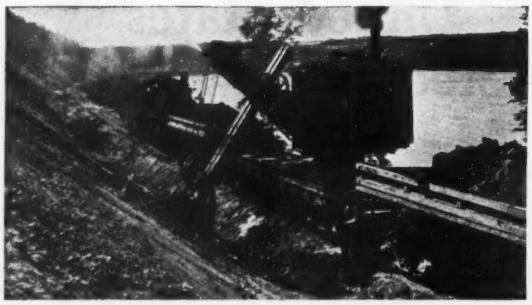
Marion
Railroad Ditchers



Model 15 Marion Ditcher on Canadian Pacific Railway

Three Big Marion Advantages

FIRST: *Independent Boom Engines.* A Marion Ditcher is able to dig through a considerably wider range because of its independent boom (or crowding) engines, thereby saving time of moving back and forth along the bank. It is also able to dig much harder material for the same reason, because of the more positive action of the dipper handle.

SECOND: *Independent Swinging Engines.* A Marion Ditcher is better able to hold its position on curves while digging. The swinging motion is positive in either direction and is not controlled by frictions or similar devices.

THIRD: *A Marion Ditcher may be easily changed into a small revolving steam shovel for work on the ground.* A truck frame for railroad wheels or traction wheels can be substituted for the regular ditcher truck frame, and the ditcher becomes a revolving shovel, suited to a revolving shovel's wide range of work.

These three are only a few of the many points of Marion Ditcher Superiority. Marion Excavating Machinery is being used on hundreds of railroads in the United States and abroad, which is good evidence of its efficiency.

THE MARION STEAM SHOVEL COMPANY
Established 1884 **MARION, OHIO**
Atlanta Chicago New York San Francisco Seattle
Manufacturers of Excavating Machinery of Every Description

DU PONT

LOW FREEZING RED CROSS EXPLOSIVES FOR RAILROAD WORK

WITH the arrival of winter days railroad work can be economically and effectually done with RED CROSS EXPLOSIVES.

Thawing explosives, with the attending dangers to life and property, is rarely necessary when Red Cross Low Freezing Explosives are used exclusively.

Efficiency, economy, greater safety and extended working seasons are the desirable results secured by the adoption of RED CROSS LOW FREEZING EXPLOSIVES.

E. I. du Pont de Nemours & Co.
Powder Makers Since 1802
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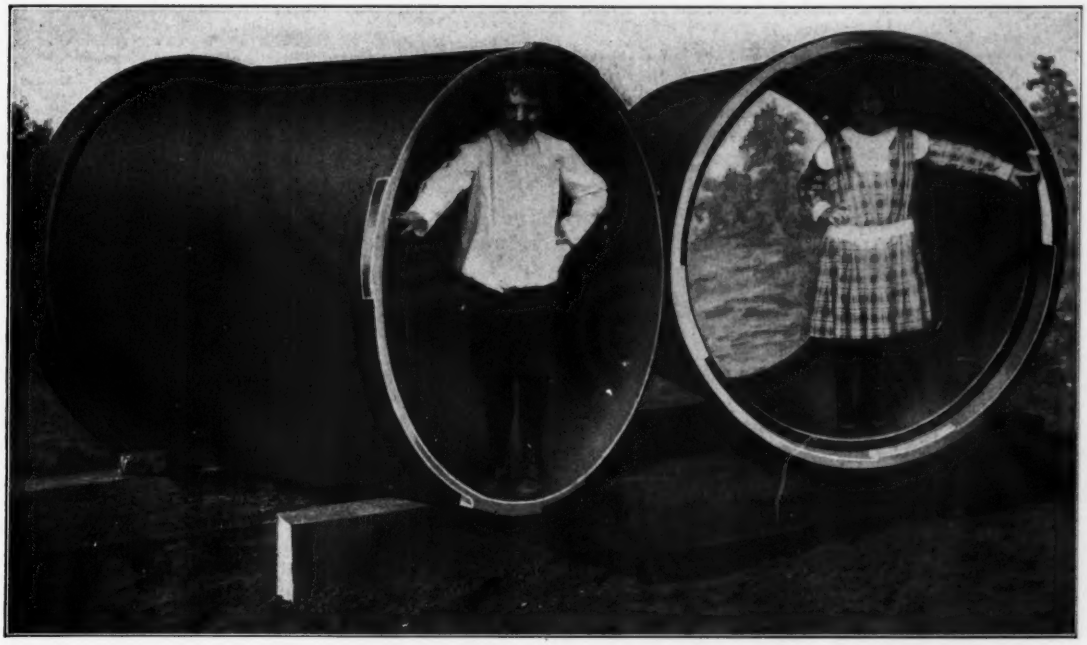

Long Years of Life Ahead of Them

Long years of life ahead of them, years of strength and usefulness.

Look at this picture. Does it not bring back the days when you, too, loved to play where work was in progress? Those "bully" afternoons when your "crowd" played "*Old Cat*," or "*Hide and Seek*," when you knocked the ball over the fence, or "were just going to," it's all the same. Remember the day you and Billy Smart hid in a culvert pipe and smoked a pipe of corn silk? That was the happy life.

Perhaps that last thought brings up another one—the short life of many culverts, the high maintenance cost due to culvert renewals. If it does, then look again at these two short units of long service

National Lock-Joint Cast-Iron Pipe

The pipe made from pure remelted Alabama Pig Iron, hence as permanent as your road bed. The pipe of short length units (3, 4 and 5 ft.) which permits easy handling. The pipe the railroads install without interfering with traffic. No piles to drive nor fills to remove. No tunneling, just rethread the old culvert and back fill with cement—that's all.

The pipe of low first cost, which is sold by the foot and which has the joint that *locks* effectively, *prevents* separation and *assures* alignment to perfection. The pipe, the specification of which has solved the Culvert problem for so many railroads.

Those "happy days" we mentioned above are gone for you and me, but "brace up," we've a lot to be thankful for—among other things, for example, National Lock-Joint Cast-Iron Pipe and the savings it effects. Catalogue and prices on request.

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